Technical Report RD-76-22

INVESTIGATION OF JET PLUME EFFECTS ON THE LONGITUDINAL STABILITY CHARACTERISTICS OF A BODY OF REVOLUTION WITH VARIOUS FIN CONFIGURATIONS AT MACH NUMBERS FROM 0.2 TO 2.3 (NORMAL JET PLUME SIMULATOR)

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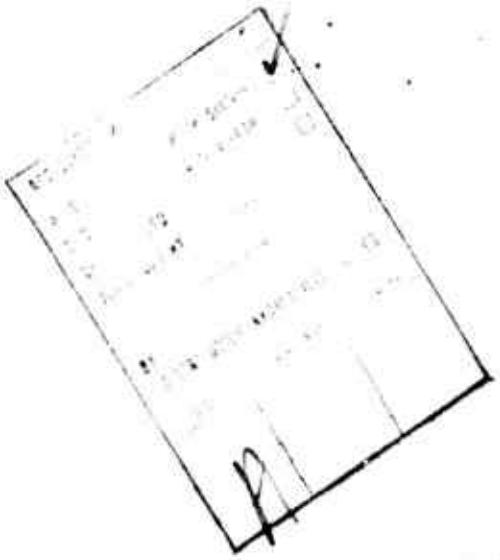
U.S. ARMY MISSILE COMMAND
Redstone Arsenal, Alabama



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Jet Plume

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Transonic wind tunnel tests were conducted on a body of revolution with various fin configurations to investigate jet plume effects on missile longitudinal stability. A series of cold air normal jets located downstream of the base were utilized to simulate the jet plume. Fins of various planform geometry were tested at a forward longitudinal location only. The angle of attack range was -4 to 11 degrees at Mach numbers of from 0.2 to 2.3. The test was run at the Arnold Engineering Development Center Transonic (16T) and Supersonic (16S) wind tunnels and was designated AEDC SF172/TF360.

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INTRODUCTION

During the past few years the Army Missile Command has been interested in the adverse effects of the propulsive jet plume on missile aerodynamics. Of particular importance are the effects on missile longitudinal stability. A research program has been established as a means of obtaining the understanding necessary for proper design of future missiles susceptible to this problem (see Reference 1).

It was previously shown that plume induced instability could be avoided by moving the fins forward from the base and using fins of sufficient size. Results also indicated that stability margin might be controlled to a precision where plume effects could be used to advantage as a means of reducing missile wind sensitivity. Later test results appear to substantiate this judgement. Fins can be located in a position to retain most of their effectiveness, while the plume still has a significant destabilizing influence on the missile body. Thus, based on available data, the desired unstable transonic-stable supersonic stability characteristics can be attained.

Previous tests at the CALSPAN transonic tunnel were made at Mach numbers up to 1.25. The present test extended the results up to a Mach number of 2.3. Also, tests were made at Mach numbers of 0.2 and 0.4 and at angles of attack up to 11 degrees to determine launch crosswind effects.

APPARATUS AND TESTS

The model is a sting mounted body of revolution, 5 inches in diameter and 5½-inches long with a 30 caliber tangent ogive nose. The model was tested in combination with two different sets of cruciform rectangular fins set at zero degrees roll. For the present test the fins were tested in the forward location only (Fin trailing edge 1.5 calibers ahead of the model base). The fin geometry is shown in figure 4.

The geometry of the fins tested is as follows:

Fin	Chord (in)	Semi span (in)
F1	5.0	2.5
F2	3.0	2.5

The plume simulator consisted of 24 sonic jets normal to the sting centerline and arranged circumferentially in two rows with a common air chamber (see figure 3). The simulator was located 0.5 caliber aft of the model base. The combined exit area of the 24 jets represented 6 per cent of the model base (reference) area. The level of plume simulation was established by setting various pressures in the simulator chamber.

Tunnels 16T and 16S are closed-circuit, continuous-flow tunnels that can be currently operated at Mach numbers from 0.20 to 1.6 and 1.5 to 2.4, respectively. The test sections are 16 by 16 ft in cross-section and 40 ft long. Details of each tunnel's capabilities and supporting equipment can be found in reference 5. Photographs of the model installed in the test sections are shown in figures 6 and 7 and sketches of the location of the models in the tunnels are shown in figure 5.

Total model force and moments were measured using a 2.0-inch, 6-component balance, with normal and side force capacities of 1800 pounds and 900 pounds, respectively. The balance was mounted in the model, such that the balance 900-pound capacity side-force gages measured model normal forces, in order to achieve better data resolution in the model pitch plane. Fin forces and moments were measured using 5-component (no axial force) balances, with a nominal normal force capacity of 60 pounds.

A static pressure measurement was made in the balance cavity and was used to calculate the balance cavity axial force. Two static pressure measurements were made at the base of the model and were used to calculate base pressure.

Model angle of attack was measured using a pendulum-type angle sensor, with a backup measurement determined from balance-sting deflections.

Steady-state data were obtained at free-stream Mach numbers from 0.2 to 2.3. The tunnel test conditions were held constant at each Mach number. Plume effects were obtained by setting and maintaining a specific value of chamber pressure while angle of attack was varied.

Model aerodynamic coefficients were tabulated in the body-axes system and referenced to model station 26.5 inches. No correction was made to the data for tunnel flow angularity. Fin moment coefficients were referenced to the fin hinge-line and fin root bending moment coefficients were referenced to the fin-body intersection. The positive orientation of the model and fin forces and moments are shown in figure 2.

TEST CONDITIONS

The test was conducted in the AEDC Propulsion Wind Tunnels, Supersonic (16S) and Transonic (16T), respectively. Tunnels 16T and 16S are closed-circuit, continuous-flow tunnels that can be currently operated at Mach numbers from 0.20 to 1.6 and 1.5 to 2.4, respectively. The purpose of the test was to determine the Mach number range of adverse jet plume effects on missile longitudinal stability. Similar data were previously obtained at the Calspan Corporation 8- Foot Transonic Wind Tunnel. Three configurations were tested (body with Fins F1, body with Fins F2, and body alone) at various simulated plume shapes, at model angles of attack from -4 to 11 degrees at zero degrees yaw, zero degrees roll, and at free-stream Mach numbers from 0.2 to 2.3. Steady-state data were obtained at these free-stream Mach numbers. The tunnel test conditions were held constant at each Mach number, and the plume shape was generated by setting a specific value of high-pressure air in the plume simulator chamber and discharging the air radially. The Radial Thrust Coefficient (CRT) is a measure of the plume shape and is a function of the free-stream Mach number and the simulator pressure. At specified levels of CRT and Mach number, the model angle of attack was varied from -4 to 11 degrees at the free-stream Mach numbers of 0.2 and 0.4. At all other Mach numbers, the angle-of-attack range was -4 to 4 degrees.

PLUME SIMULATION

In the past, the Army Missile Command has used base pressure ratio p_b/p_∞ as an indication of the onset and the severity of plume effects on missile aerodynamics (see reference 1). One of the parameters that can be conveniently used to correlate base pressure is thrust coefficient CT, where CT is axial thrust non-dimensionalized by dynamic pressure and body cross-sectional area, (S_{ref}). For the normal jet simulator a similar parameter is radial thrust coefficient, CRT, where

$$CRT = \frac{\text{Radial Thrust}}{qA}$$

Radial thrust is the summation of the thrust of the 24 individual nozzles. For an axial jet, base pressure appears to be primarily influenced by the portion of the jet plume in the vicinity of the jet boundary where it interacts with the freestream flow. Where CT can be considered to represent the axial component of the effective jet, it can be assumed that CRT represents the normal component.

For the plume size of interest in the present investigation a value of CT several times the value of CRT is required for matching base pressures. The exact CT/CRT ratio will depend on a comparison of flight base pressures with base pressure values for the normal jet simulator. Where flight base pressures are unavailable, methods exist which allow simulation of flight rockets with cold air axial jets (see, for example reference 6). An estimate of the CT/CRT ratio (although crude) is valuable for use in preliminary design and insuring that the range of CRT values planned for wind tunnel tests are sufficient.

RESULTS

Data presented in the plots show radial thrust effects on stability characteristics, fin normal force, fin hinge moment, and fin root bending moment. Radial thrust effect on longitudinal derivatives and hysteresis effects are also plotted.

The transonic portion of the test was run 24-25 January 1975 and was designated TF360. Several runs were made to determine plume effects at high angles of attack and at low Mach numbers. These conditions approximate exit from the launcher for a free rocket configuration. Typical results at these conditions are shown for the body alone (B) configuration on page 2 of the data figures. Significant plume effects are apparent when the thrust level is increased to a CRT value of 12. With a further increase of CRT to 37.5, plume effects are more severe--but only at angles of attack between $\pm$ 1.5 degrees. At higher angles of attack stability characteristics tend to approach the jet-off case. These results suggest that the plume effects at a CRT of 37.5 reach forward to the ogive portion of the body or possibly the nose tip. In this case, the short body tested does not represent the plume effects on a much longer body such as that being considered for the free rocket technology program configuration. Therefore, it is recommended that plume effects on long bodies be investigated for several typical conditions.

REFERENCES

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5. Test Facilities Handbook (Tenth Edition). "Propulsion Wind Tunnel Facility, Vol. 4." Arnold Engineering Development Center, May 1974.
6. Korst, H. H., Approximate Determination of Jet Contours Near the Exit of Axially Symmetrical Nozzles as a Basis for Plume Modeling, Technical Report No. RD-72-14, August 1973, U. S. Army Missile Command, Redstone Arsenal, Alabama.

NOMENCLATURE

SYMBOL	PLOT SYMBOL	DEFINITION
RN/L	RN/L	unit Reynolds number; per ft
V		velocity; ft/sec
α	ALPHA	angle of attack, degrees
β	BETA	angle of sideslip, degrees
ψ	PSI	angle of yaw, degrees
ϕ	PHI	angle of roll, degrees
ρ		mass density; slugs/ft^3
C_T	CT	thrust coefficient, axial thrust/qS
C_T	CRT	radial thrust coefficient, radial thrust/qS
$P_{b_{AVG}}/P_\infty$	PB/P1	ratio of average base pressure to tunnel freestream static pressure
F.P.	FINPOS	fin position on body: 1. AFT; Fin Hinge line at M.S. 49.750 2. MID; Fin Hinge line at M.S. 46.000 3. FWD; Fin Hinge line at M.S. 42.250
a		speed of sound; ft/sec
C_p	CP	pressure coefficient; $(p_1 - p_\infty)/q$
M	MACH	Mach number; V/a
p		pressure; psf
q	Q(NSM) Q(PSF)	dynamic pressure; $1/2\rho V^2$, psf
p_b/p_∞		base pressure ratio

NOMENCLATURE (Continued)

Reference & C.G. Definitions

A_b		base area; m^2, in^2
b	BREF	wing span or reference span; m, in
c.g.		center of gravity
ℓ_{REF}, $\bar{c}$	LREF	reference length or wing mean aerodynamic chord; m, in
S, S_{ref}	SREF	reference area based on body diameter, in^2
	MRP	moment reference point
	XMRP	moment reference point on X axis
	YMRP	moment reference point on Y axis
	ZMRP	moment reference point on Z axis

Fin Balances

$C_{N_{F_x}}$	CNFX	fin normal force coefficient, $\frac{\text{fin normal force}}{qS_{ref}}$
$C_{m_{H_x}}$	CLMHX	fin hinge moment coefficient, $\frac{\text{fin hinge moment}}{qS_{ref}\ell_{ref}}$
$C_{m_{R_x}}$	CLMRX	fin root bending moment coefficient, $\frac{\text{fin root bending moment}}{qS_{ref}\ell_{ref}}$
$X_{CP_{F_x}}$	XCPFX	chordwise center of pressure location relative to fin hinge line, positive toward the leading edge, inches
$C_{N_{F_{x_\alpha}}}$	CNFXALFA	fin normal force coefficient derivative with angle, per degree

NOMENCLATURE (Concluded)

Body-Axis System (Main Balance)

C_N	CN	normal-force coefficient; $\frac{\text{normal force}}{qS}$
C_A	CA	axial-force coefficient; $\frac{\text{axial force}}{qS}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS\ell_{REF}}$
C_n	CYN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qSb}$
C_ℓ	CBL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qSb}$
C_{m_α}	CLMALF	pitching moment coefficient derivative with alpha, per degree
C_{N_α}	CNALFA	normal force coefficient derivative with respect to angle of attack, per degree

SUBSCRIPTS

b	base
l	local
s	static conditions
t	total conditions
∞	free stream

TABLE 1.

TEST : AEDC SF172/TF360 | DATA SET/RUN NUMBER COLLATION SUMMARY | DATE : 01-20-76

DATA SET IDENTIFIER	CONFIGURATION	SCHD. CRT	SCHD. β	PARAMETERS/VALUES α	PARAMETERS/VALUES ϕ			NO. OF RUNS	MACH NUMBERS (OR ALTERNATE INDEPENDENT VARIABLE) 2.0									TEST RUN NUMBERS
RXE001	B	C	0	0	0				60*									

CN	CLM	CY	CYN	CBL	CA	PB/P1	MACH	CRT	7

TYPE OF DATA α OR β SCHEDULES

COEFFICIENT SCHEDULES

CRT(C) = 1.5, 3.0, 9.0, 14.2, 18.2

*SF172

IDVAR (1) IDVAR (2) NDV

TABLE 1. (Continued)

TEST: AEDC SF172/TF360 — DATA SET/RUN NUMBER COLLATION SUMMARY — DATE: 01-20-76

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	PARAMETERS φ	PARAMETERS F.P.	MACH	CRT (OR ALTERNATE INDEPENDENT VARIABLE) 0.01	1	2	3	4	6	6.5	12	25	37.5	50	100	TEST RUN NUMBERS
RXEΔ*02	B	A	0	0	-	0.2	128								129		130	133	
03		A				0.4	134							135		136			
04		B				1.0	137					138							
05						1.25	139			140	141	142		143					
06						1.5	144		145	146	147	148		149					
07						1.7	45*		46*	47*	48*	49*							
08						2.0	56*		57*		58*	59*							
09	BF1	A			3	0.2	103								104		105	107	
11		A				0.4	109							110		111			
12		B				1.0	112					113							
13						1.25	114			115	116	117		118					
14						1.50	119		120	121	123	122	124	125					
15						1.7	18*		19*	22*	20*	21*							
16						2.0	30*		31*		32*	33*		34*					
17		A				2.3	36*		37*		38*	39*		40*					
18	BF2	A				0.2	172					173		174	175		176	177	
19	BF2	B				0.4	168					169		170		171			

*Δ=0 DATA	CN	CLM	CY	CYN	CBL	CA	PB/PI			CRT	ALPHA	7
Δ=1 DATA	CNF1	CNF2	CNF3	CNF4	XCPF1	XCPF2	XCPF3	XCPF4		CRT	ALPHA	8
Δ=2 DATA	CLMH1	CLMH2	CLMH3	CLMH4	CLMR1	CLMR2	CLMR3	CLMR4		CRT	ALPHA	8

TYPE OF DATA α OR β SCHEDULES — COEFFICIENT SCHEDULES — IDVAR (1) — IDVAR (2) — NDV

α (A) = -4,-3,-2,-1.5,-1,-0.5,0,0.5,1,1.5,2,3,4,5,7,9,11

α (B) = -4,-3,-2,-1.5,-1,-0.5,0,0.5,1,1.5,2,3,4 *SF172

TABLE 1. (Concluded)

TEST: AEOC SF172/TF360 — DATA SET/RUN NUMBER COLLATION SUMMARY — DATE: 01-20-76

DATA SET IDENTIFIER	CONFIGURATION	SCHD. α	SCHD. β	PARAMETERS ϕ	PARAMETERS F.P	PARAMETERS MACH	CRT (OR ALTERNATE INDEPENDENT VARIABLE) 0.01	1	2	3	4	6	6.5	12	25	37.5	50	100	TEST RUN NUMBERS
RXEΔ*20	BF2	B	0	0	3	1.0	152					153							
21						1.25	154	155	156	157	158	159		160					
22						1.5	161	162	163	164	165	166		167					
23		A				0.2											131		
24																	132		
25																	108	106	

*Δ=0 OATA	CN	CLM	CY	CYN	CBL	CA	PB/P1			CRT	ALPHA	7
Δ=1 OATA	CNF1	CNF2	CNF3	CNF4	XCPF1	XCPF2	XCPF3	XCPF4		CRT	ALPHA	8
Δ=2 DATA	CLMH1	CLMH2	CLMH3	CLMH4	CLR1	CLMR2	CLMR3	CLMR4		CRT	ALPHA	8

TYPE OF DATA α OR β SCHEDULES: α decreasing for runs 106, 108, 131, 132

COEFFICIENT SCHEDULES — IDVAR (1) — IDVAR (2) — NDV

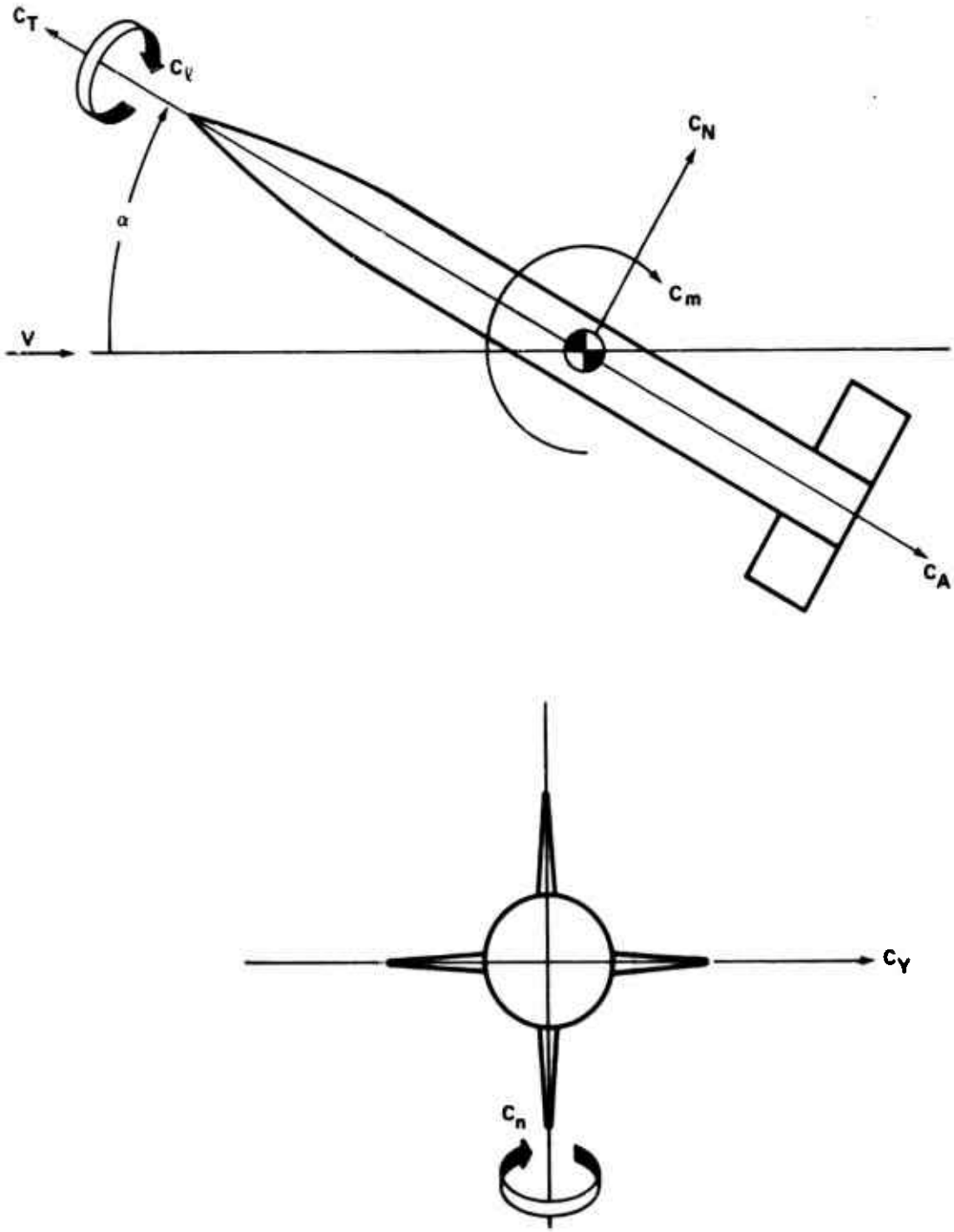
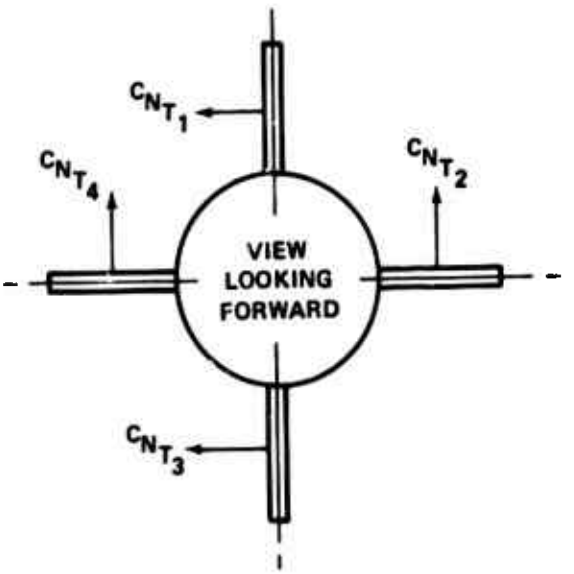


Figure 1 - Axis System Sign Convention for Main Balance



TAIL FINS

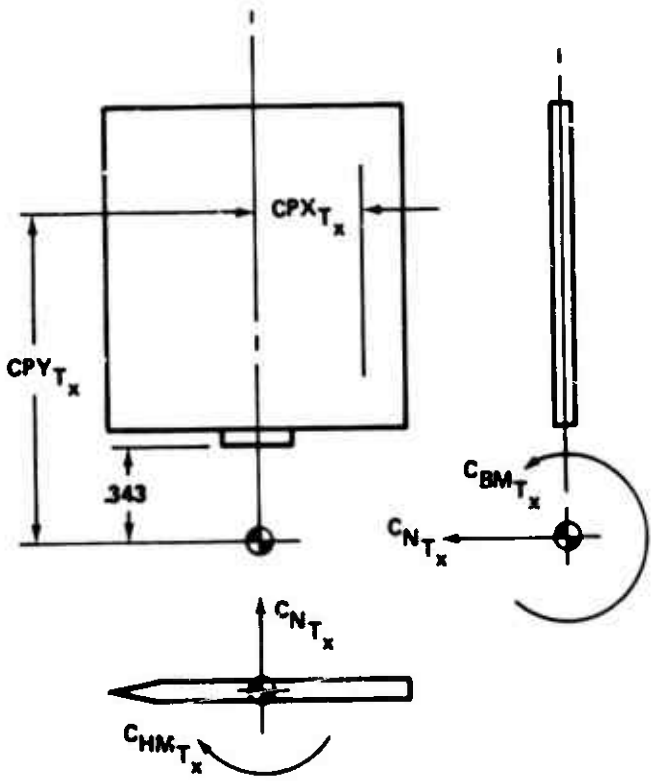


Figure 2 - Axis System and Positive Sign Convention for Fins

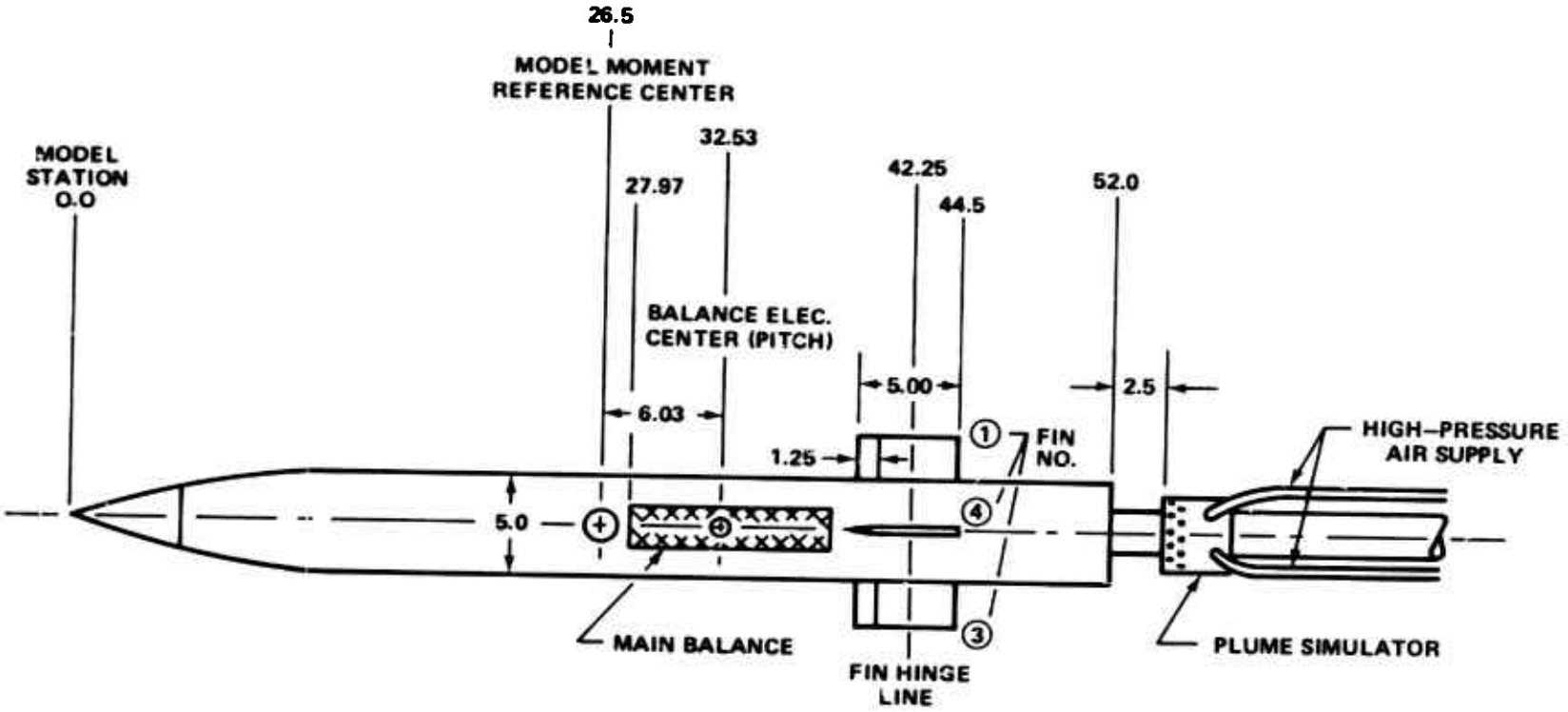


Figure 3 - AMC Model Drawing

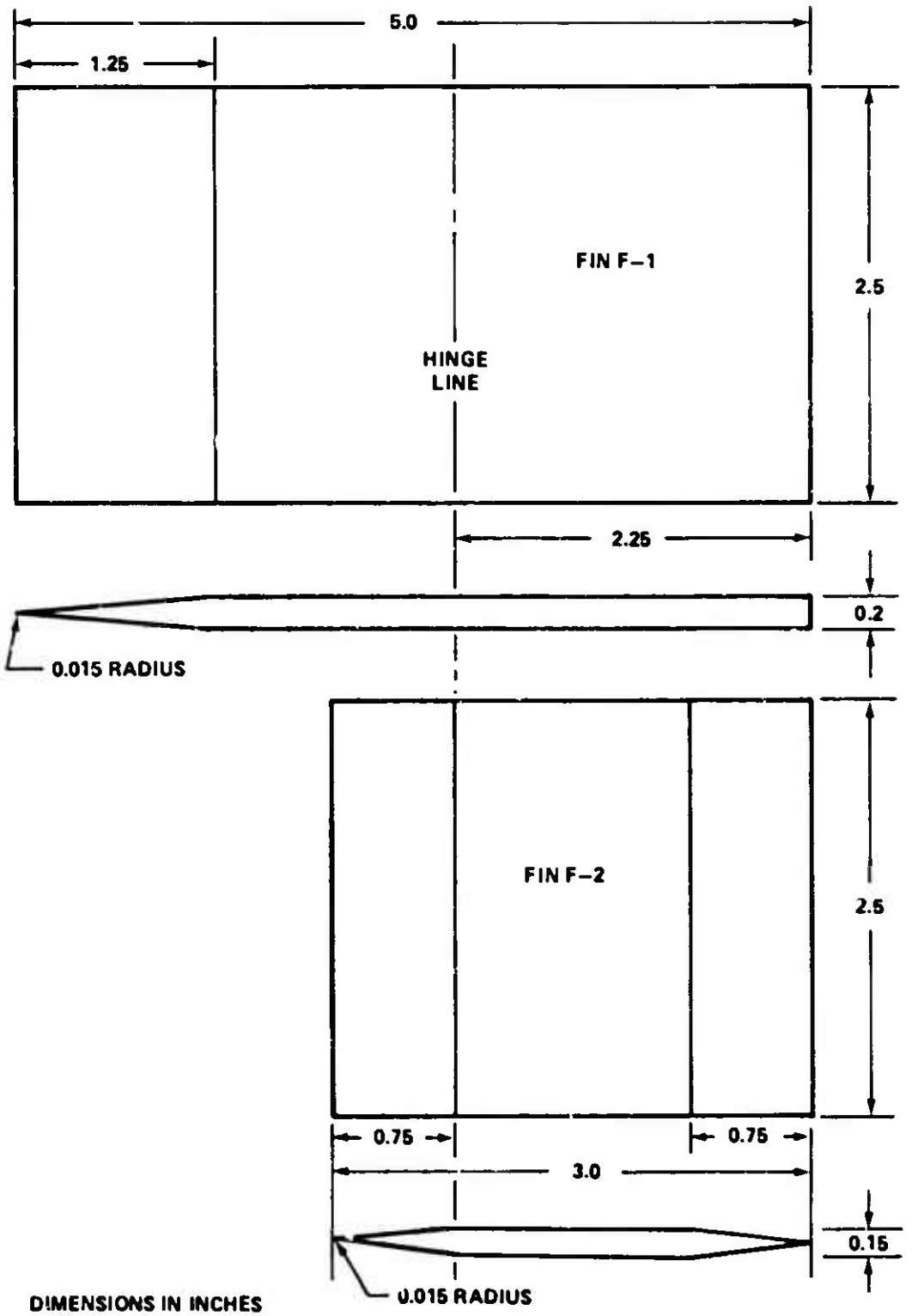
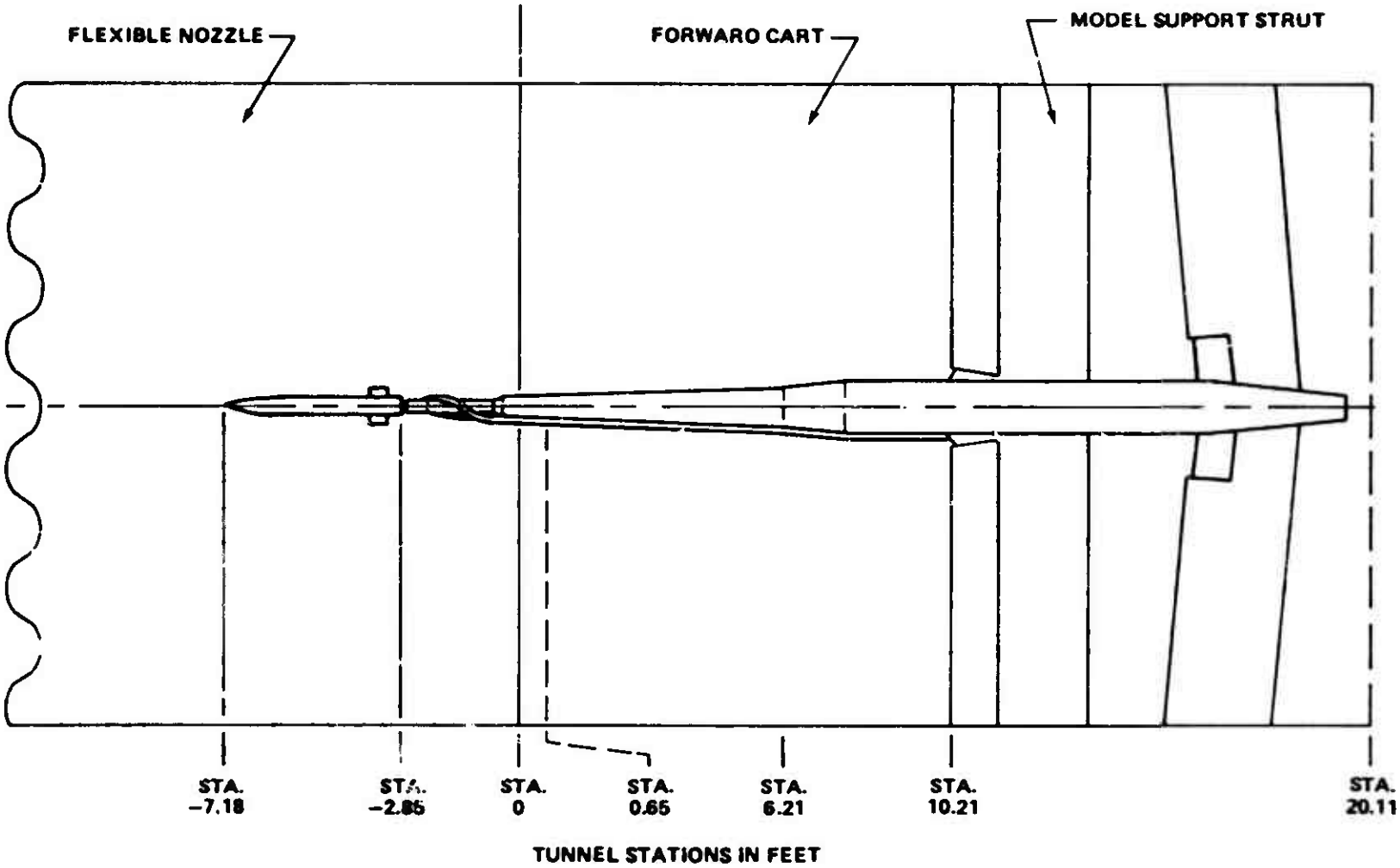
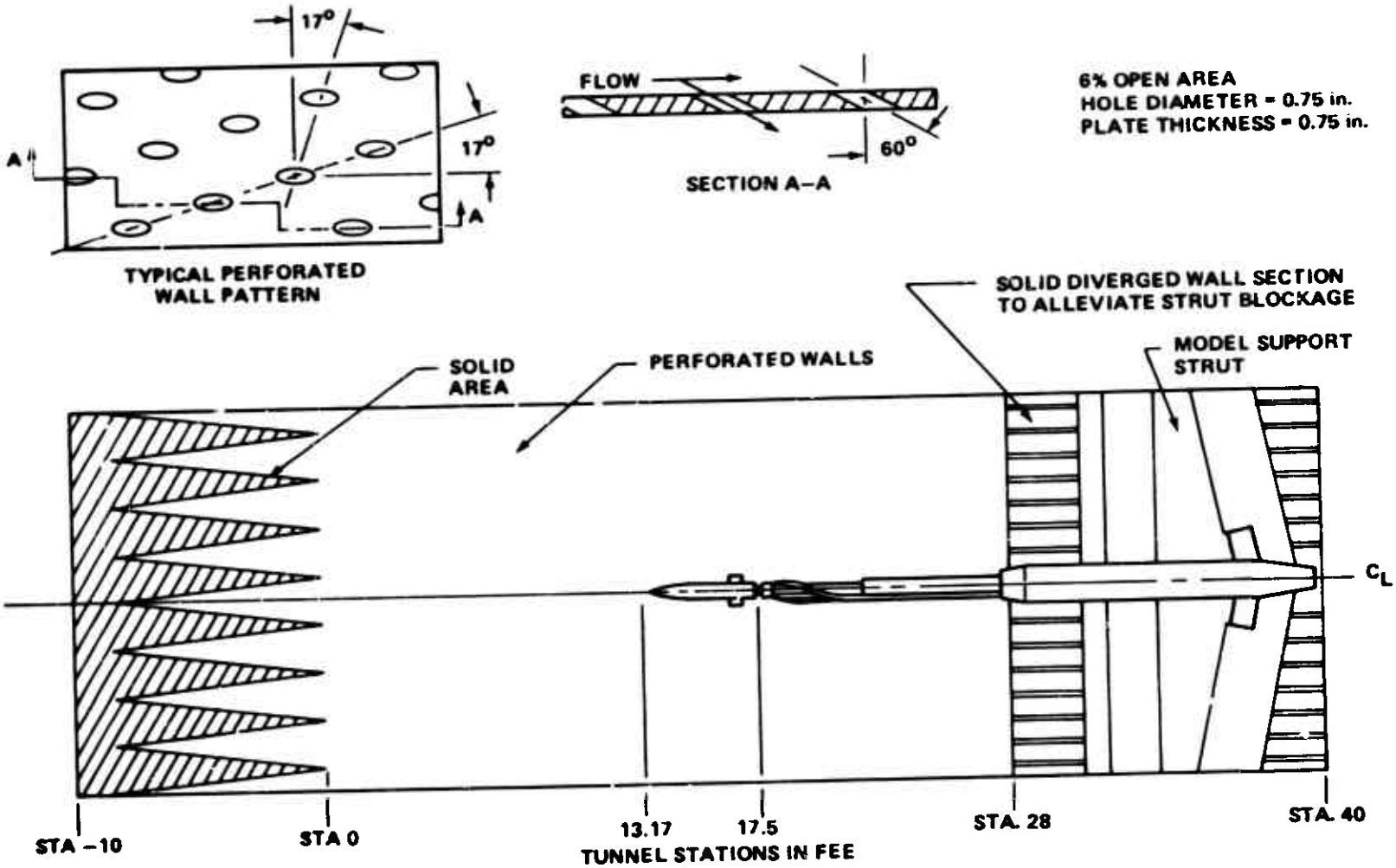


Figure 4 - Sketch of Fins F1 and F4



a. Tunnel 16S

Figure 5 - Sketch of Model Installation



b. Tunnel 16T

Figure 5. Concluded

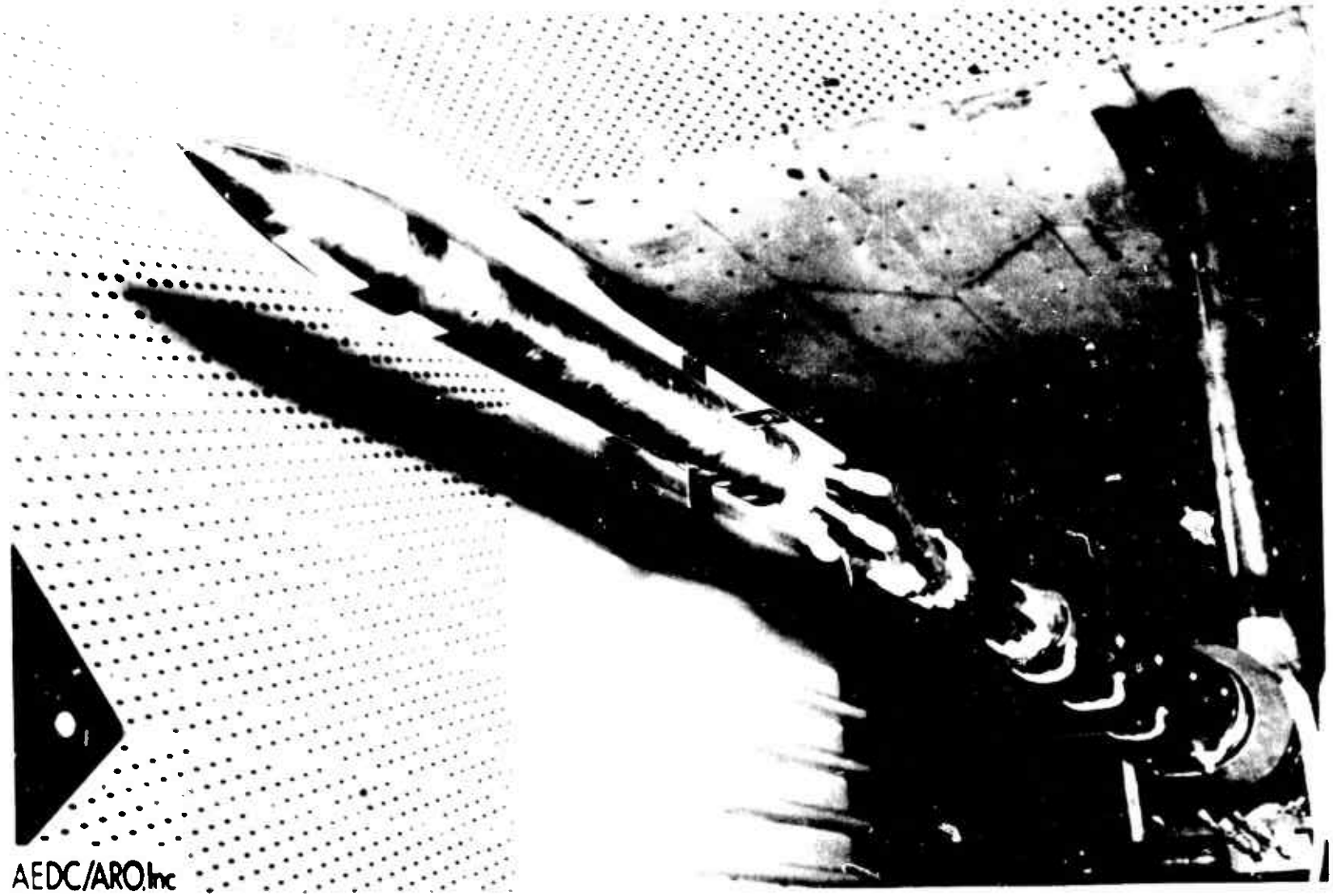


Figure 6 - Photograph of Model (BF2) in PWT (16T)

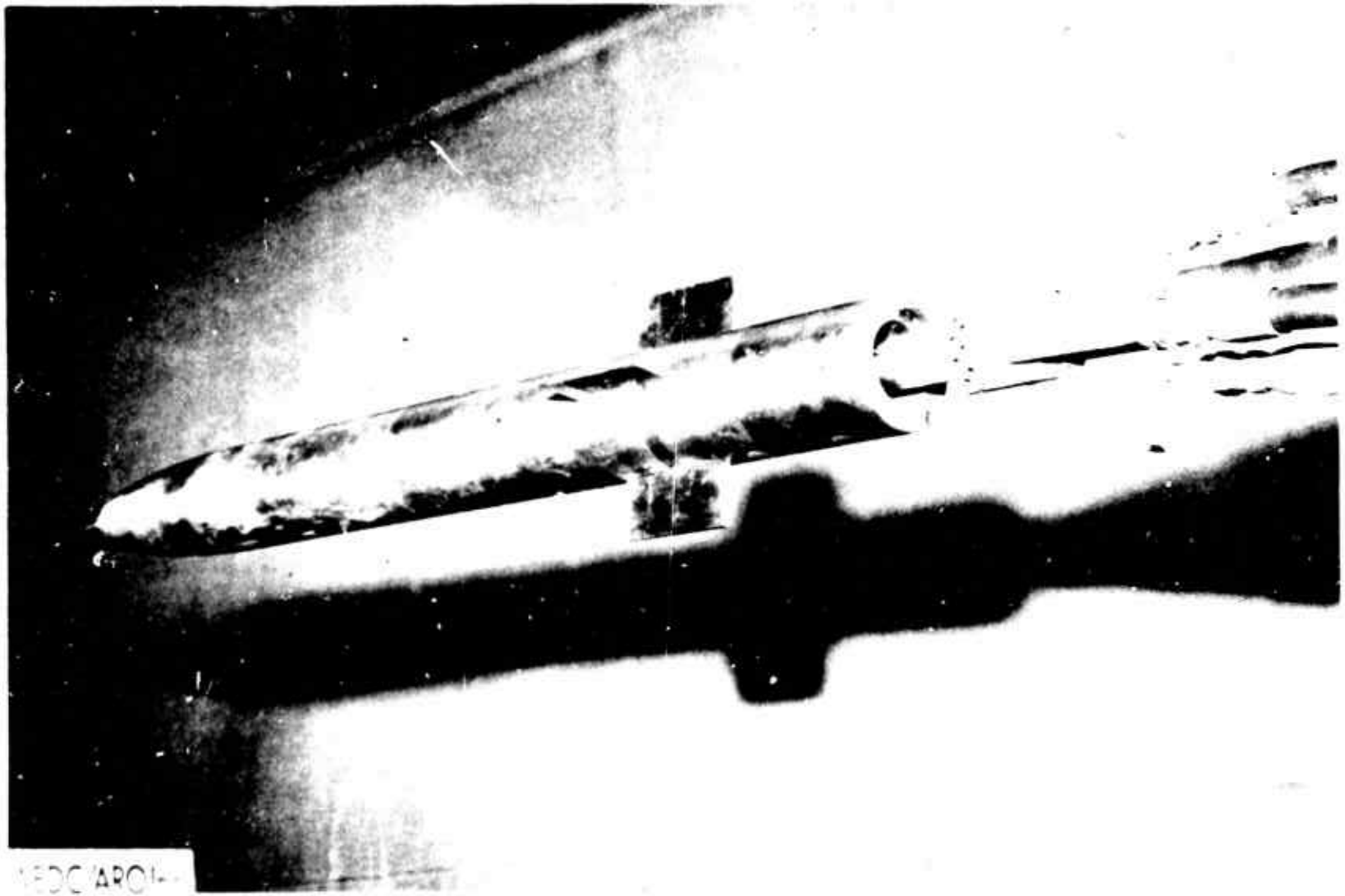


Figure 7. - Photograph of Model (BF1) in PWT (16S)

PLOTTED DATA

Tabulations of the plotted data and corresponding source data are available from Data Management Services Operations.

AEDC TF360 BODY ALONE.B (RXE002)

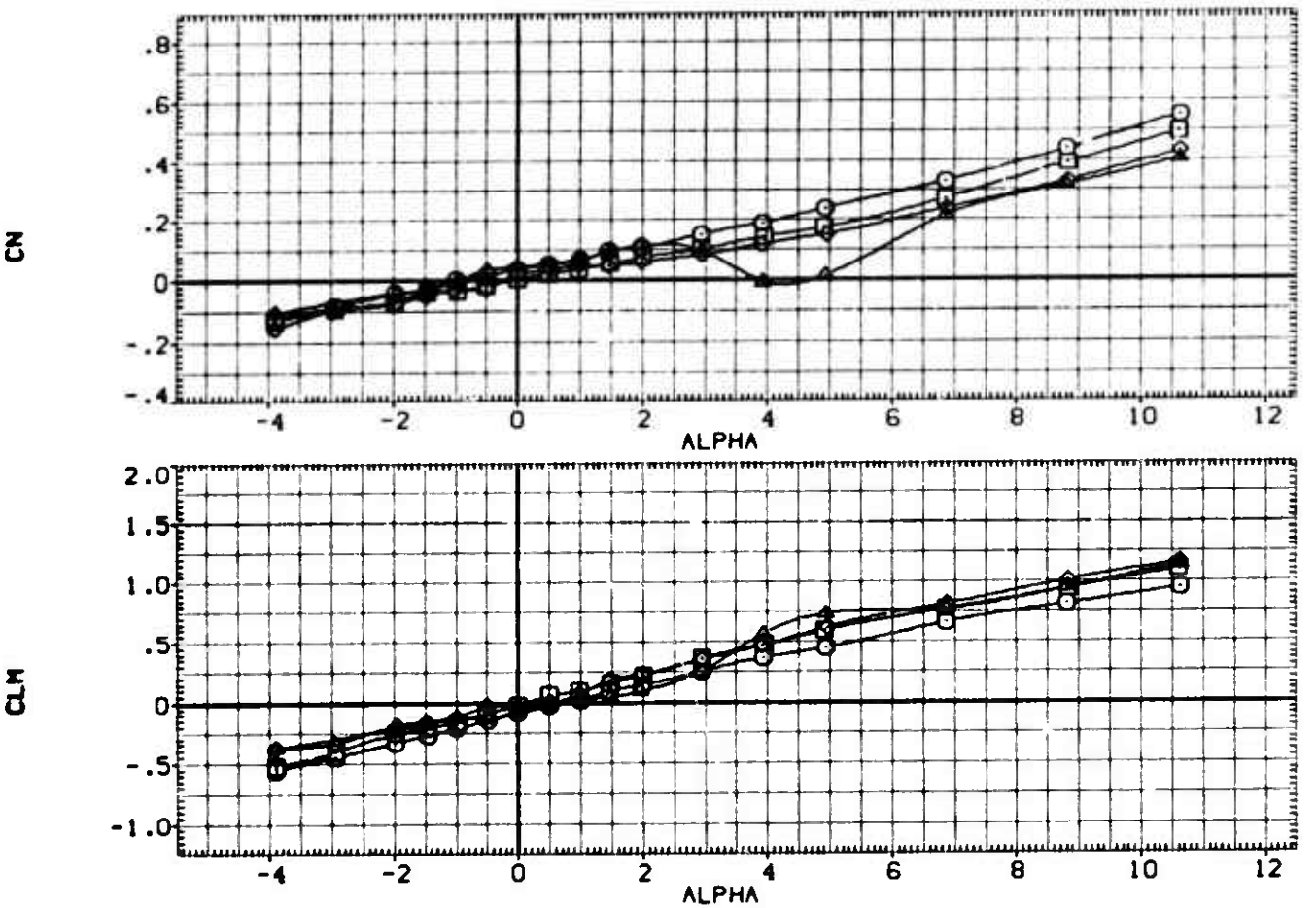
SYMBOL	CRT
○	.585
□	25.602
◇	50.611
△	101.026

PARAMETRIC VALUES

BETA	.000	PHI	.000
MACH	.200		

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY ALONE,B (RXED03)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.109	BETA	.000	PHI	.000
□	12.013	MACH	.400		
◇	37.151				

REFFRENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
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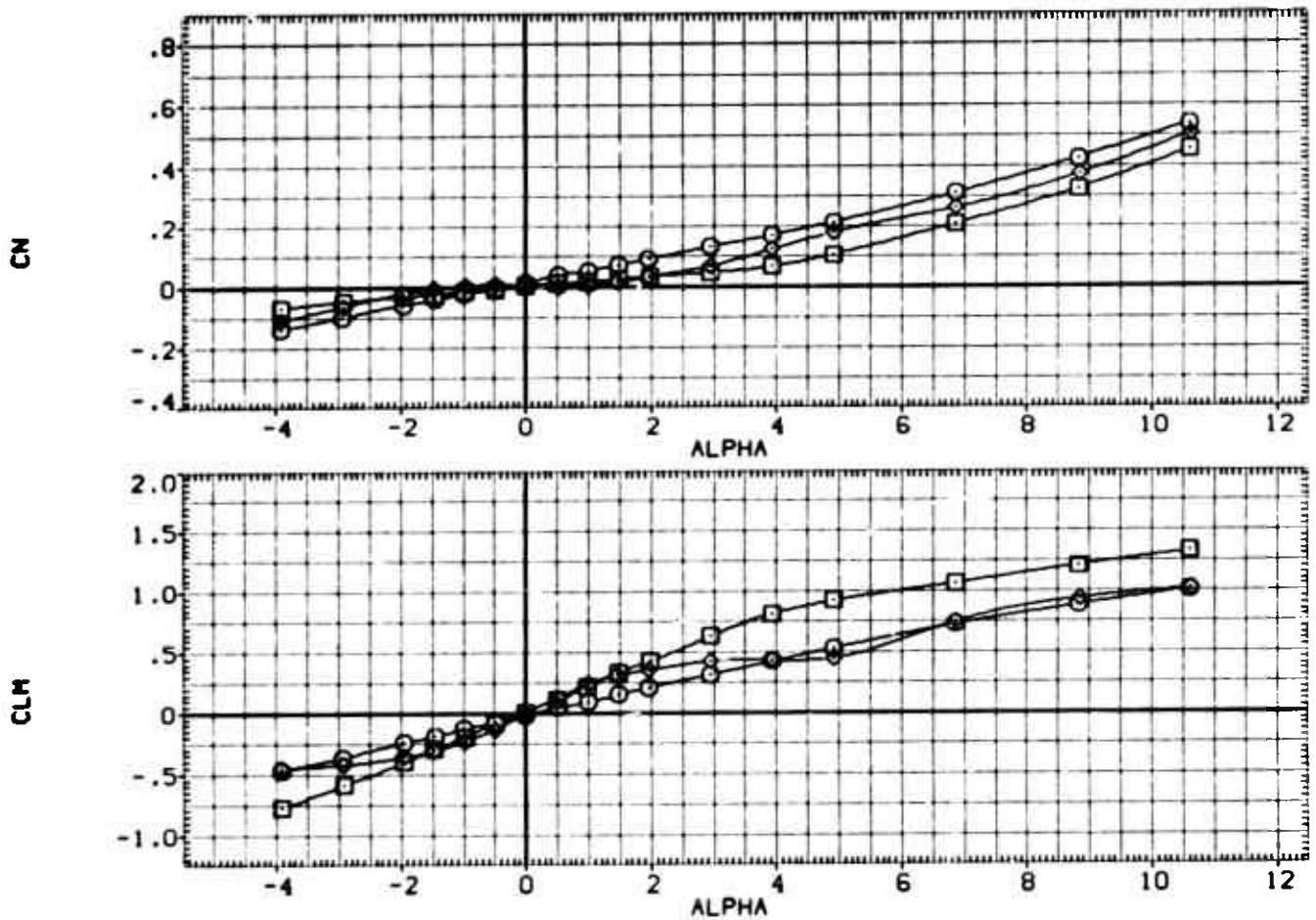
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0200	



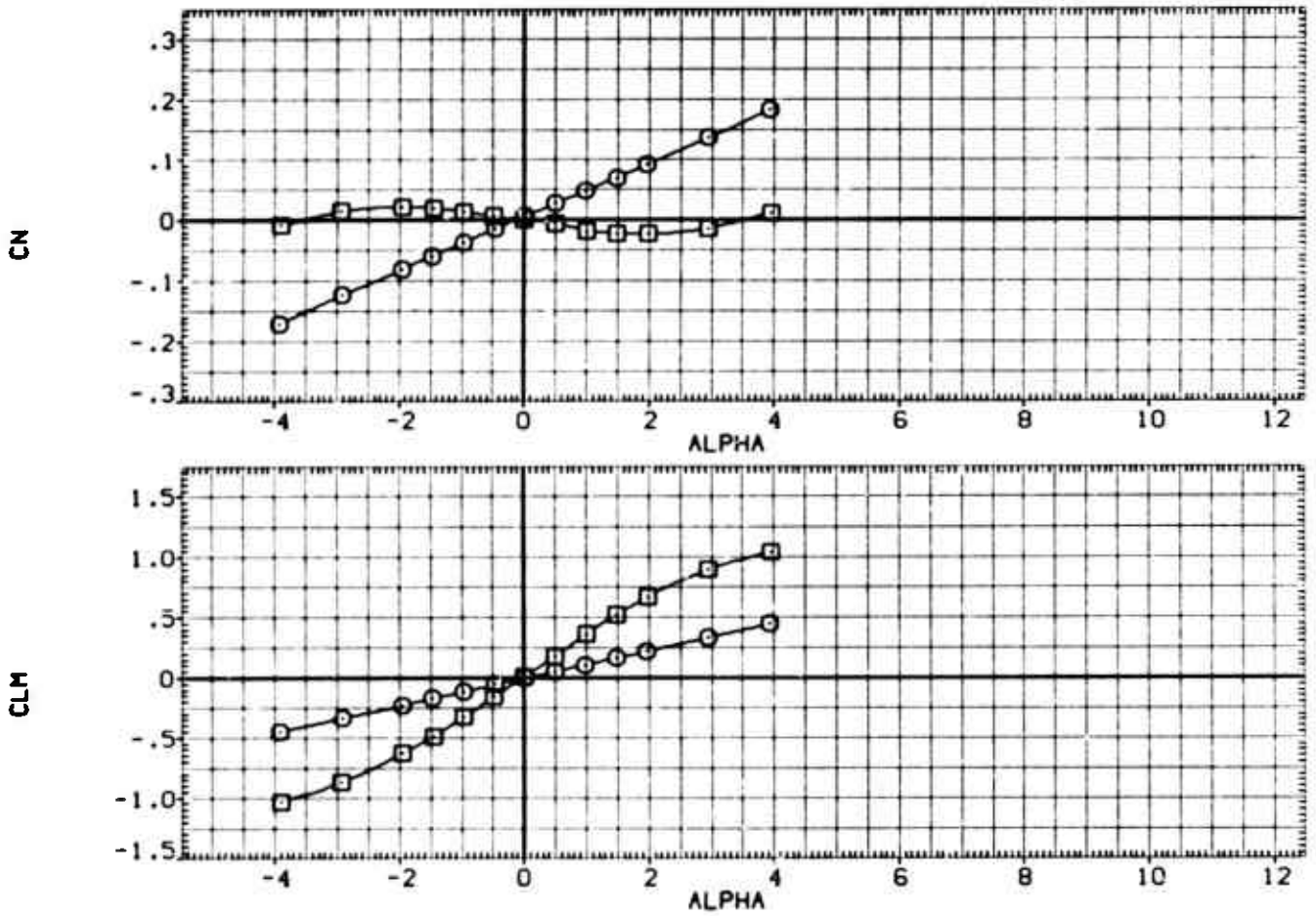
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY ALONE.B (RXE004)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.023	BETA	.000	PHI	.000
□	6.100	MACH	1.000		

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	

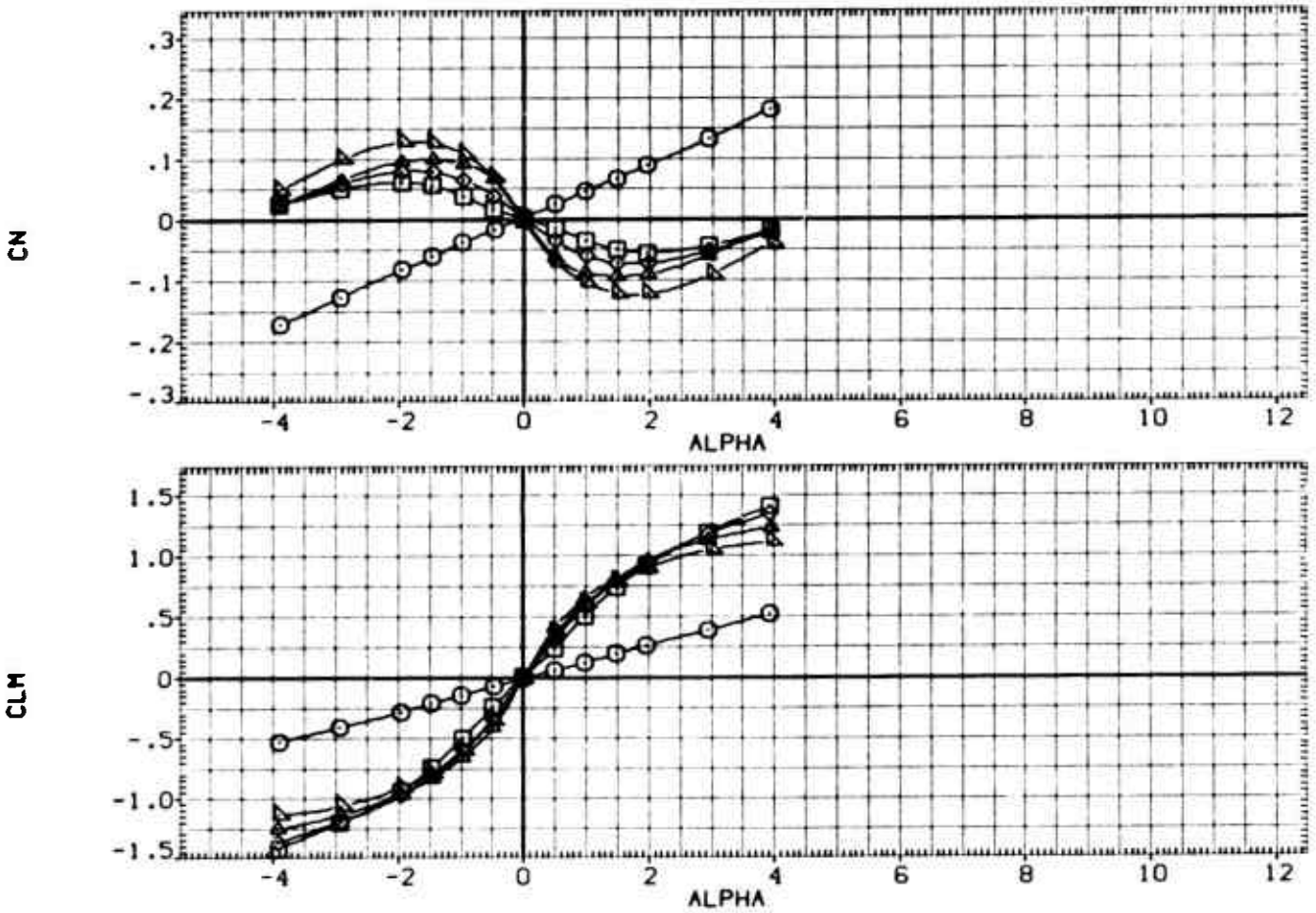


THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY ALONE.B (RXE005)

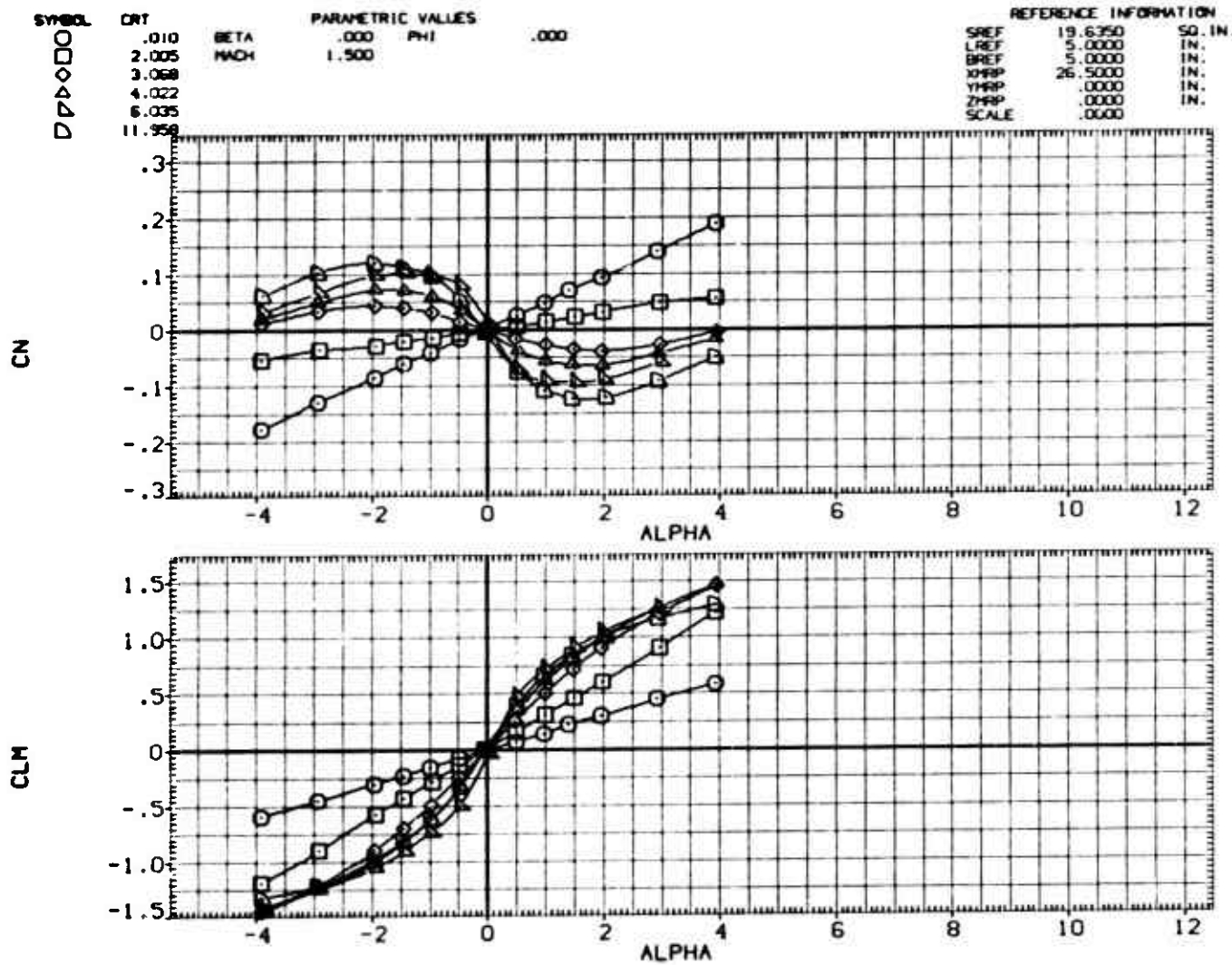
SYMBOL	CRT	PARAMETRIC VALUES			
□	.010	BETA	.000	PHI	.000
◇	3.035	MACH	1.250		
△	4.013				
▷	5.976				
○	11.955				

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY ALONE, B (RXE006)



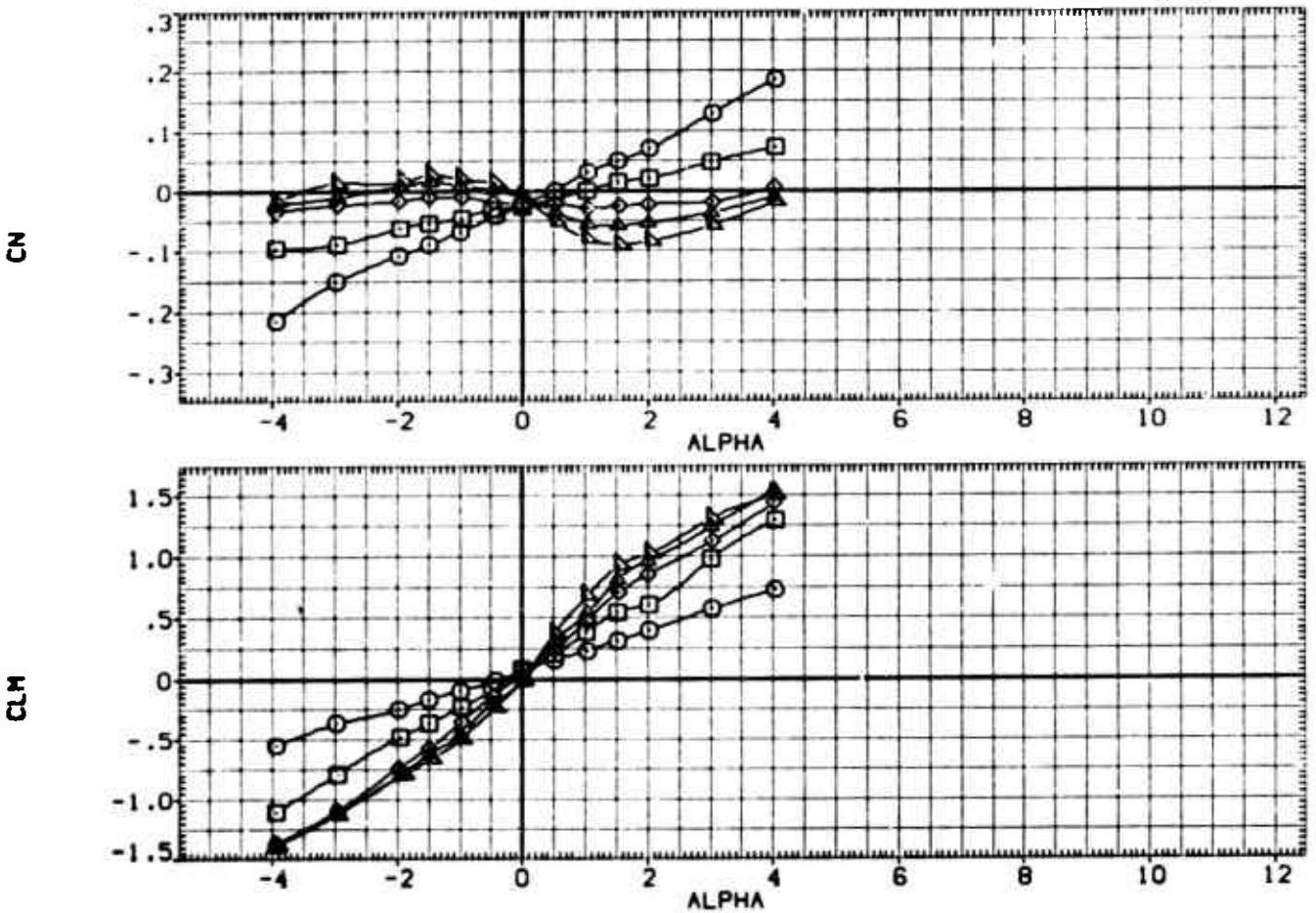
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEOC SF172 BODY ALONE, B (RXE007)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.018	BETA	.000	PHI	.000
□	2.046	MACH	1.700		
◇	3.009				
△	4.001				
▽	6.030				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



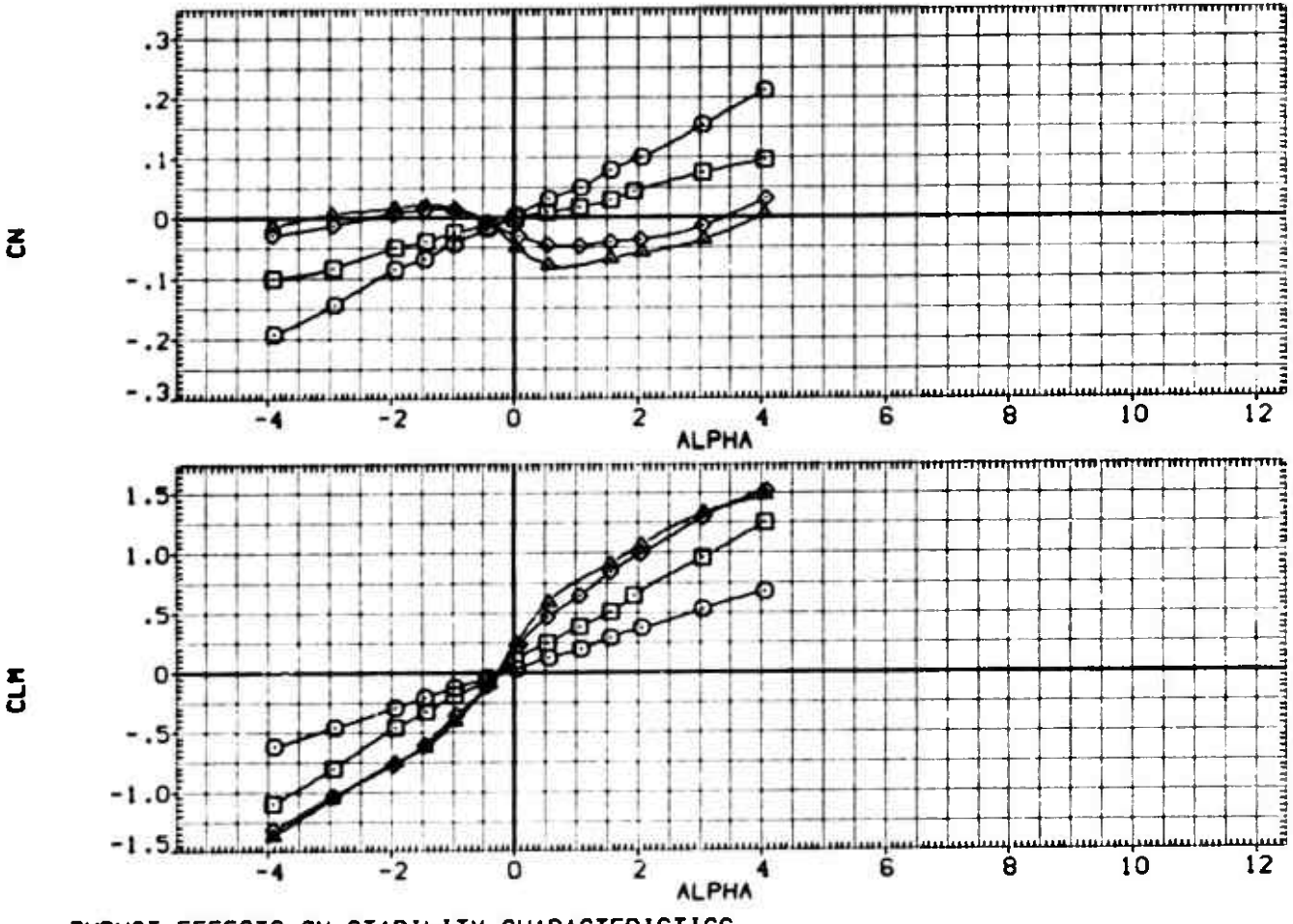
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEOC SF172 BODY ALONE.B (RXE008)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.008	BETA	.000	PHI	.000
□	2.004	MACH	2.000		
◇	3.985				
△	6.005				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0010	

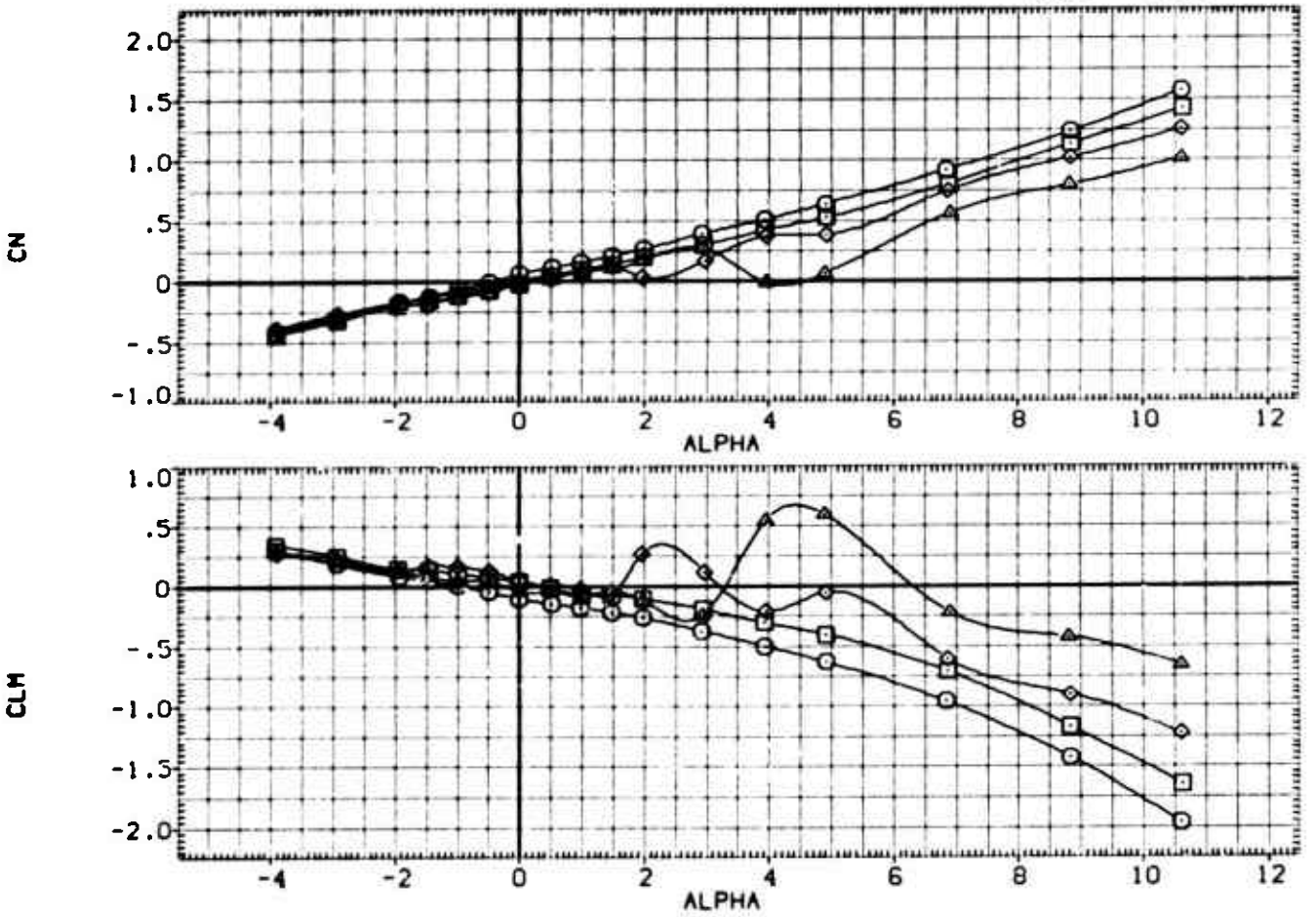


THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN, BF1 (RXE009)

SYMBOL	CRT	PARAMETRIC VALUES			
○	.575	BETA	.000	PHI	.000
□	26.074	FINPOS	3.000	MACH	.200
◇	50.139				
△	100.918				

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



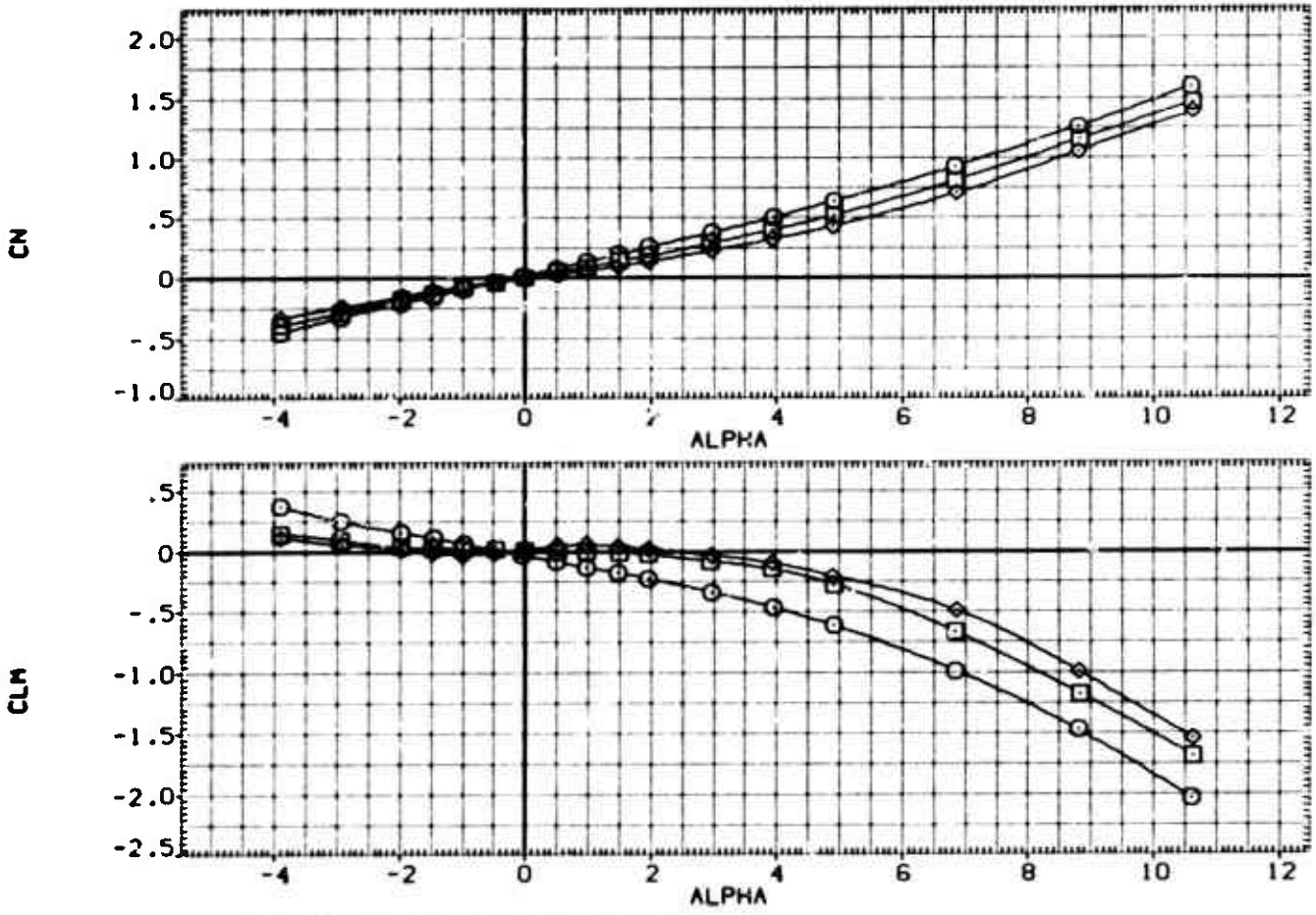
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN. BF1 (RXE011)

SYMBOL	ORT		PARAMETRIC VALUES		
○	.122	BETA	.000	PHI	.000
□	11.977	FINPOS	3.000	MACH	.400
◇	37.520				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



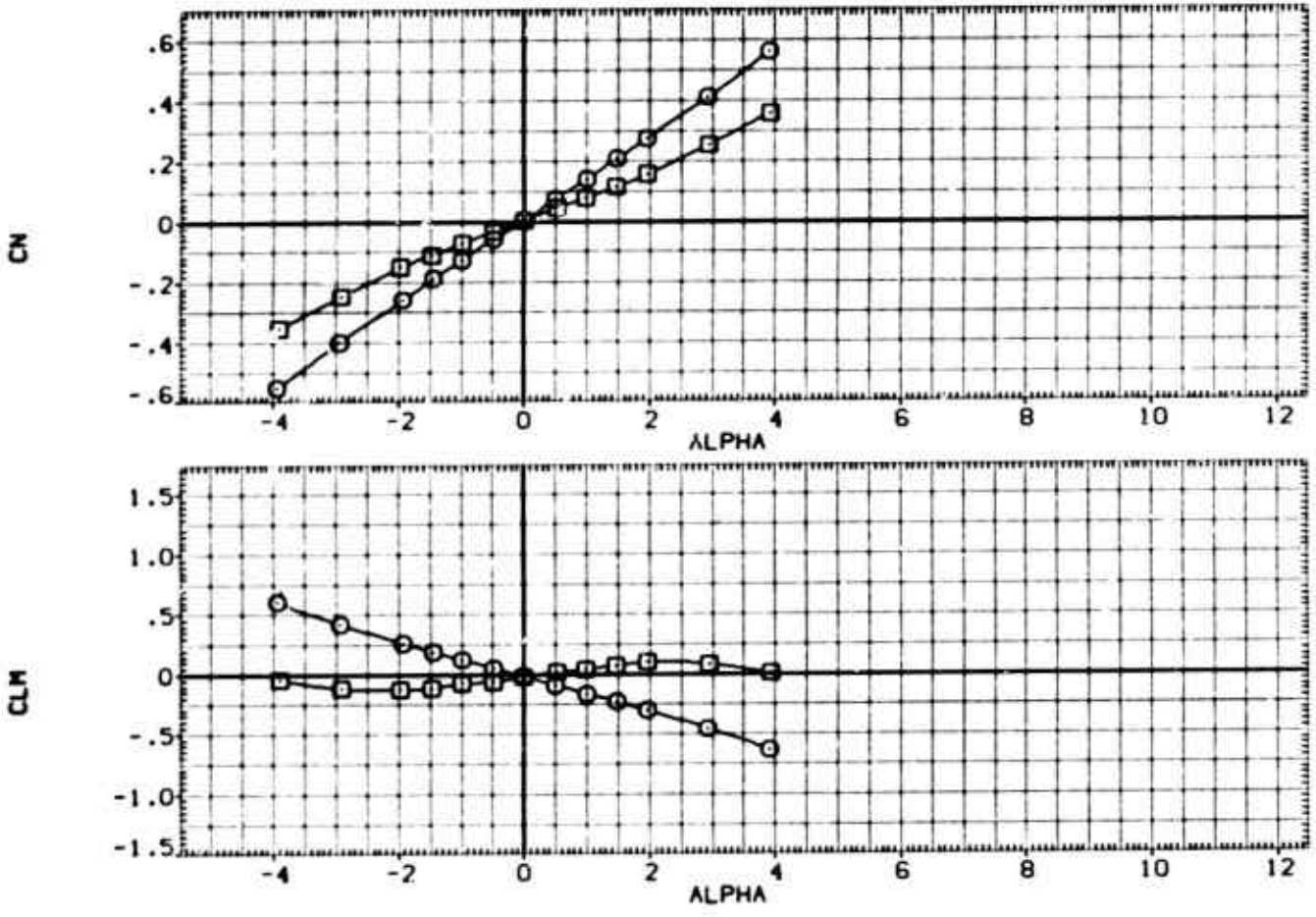
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN. BF1 (RXE012)

SYMBOL	CAT		PARAMETRIC VALUES		
○	.012	BETA	.000	PHI	.000
□	5.885	FINPOS	3.000	MACH	1.000

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



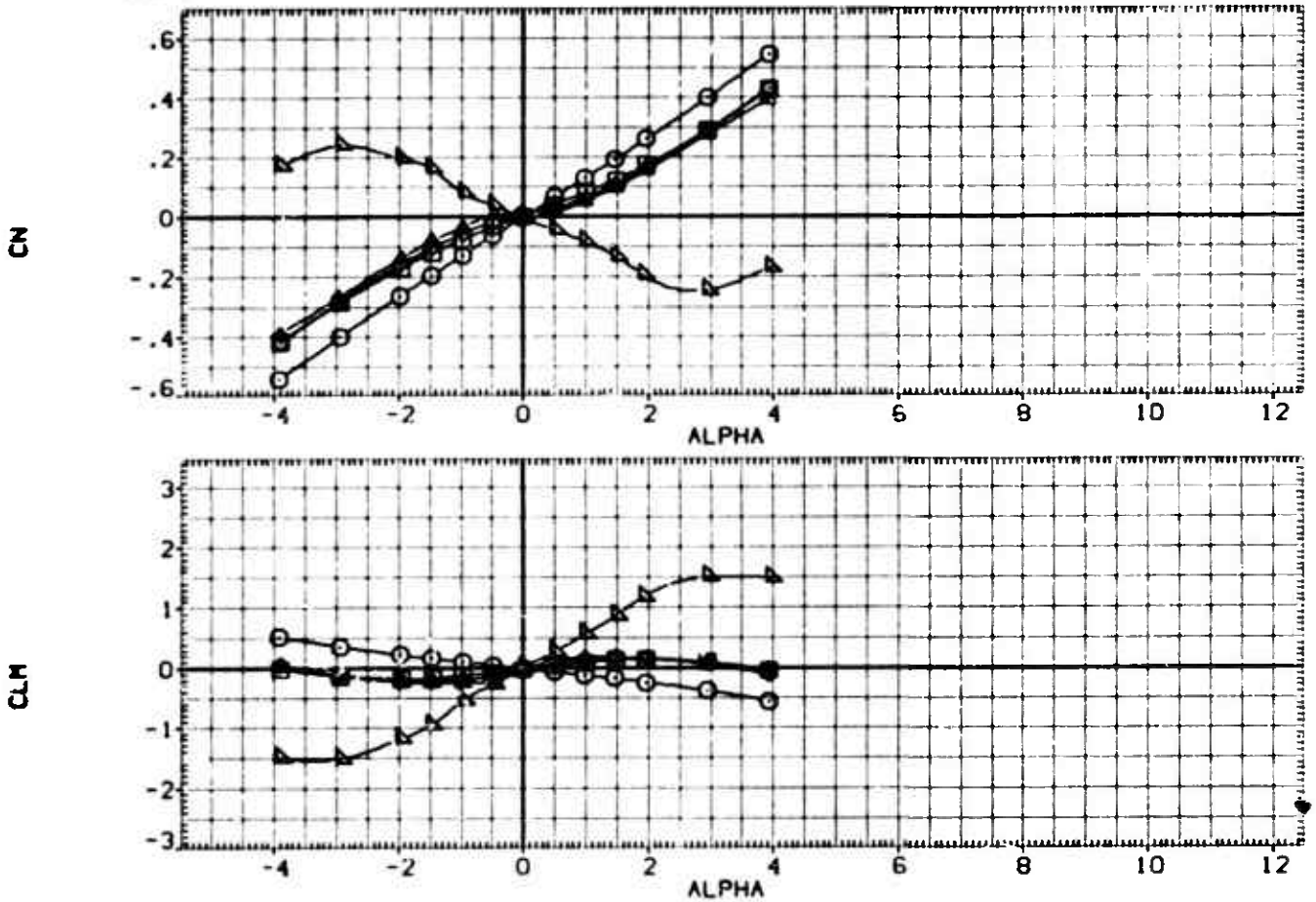
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN. BF1 (RXED13)

SYMBOL	CNT		PARAMETRIC VALUES		
▷	.010	BETA	.000	PHI	.000
◇	3.042	FINPOS	3.000	MACH	1.250
□	4.014				
△	6.006				
○	11.975				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



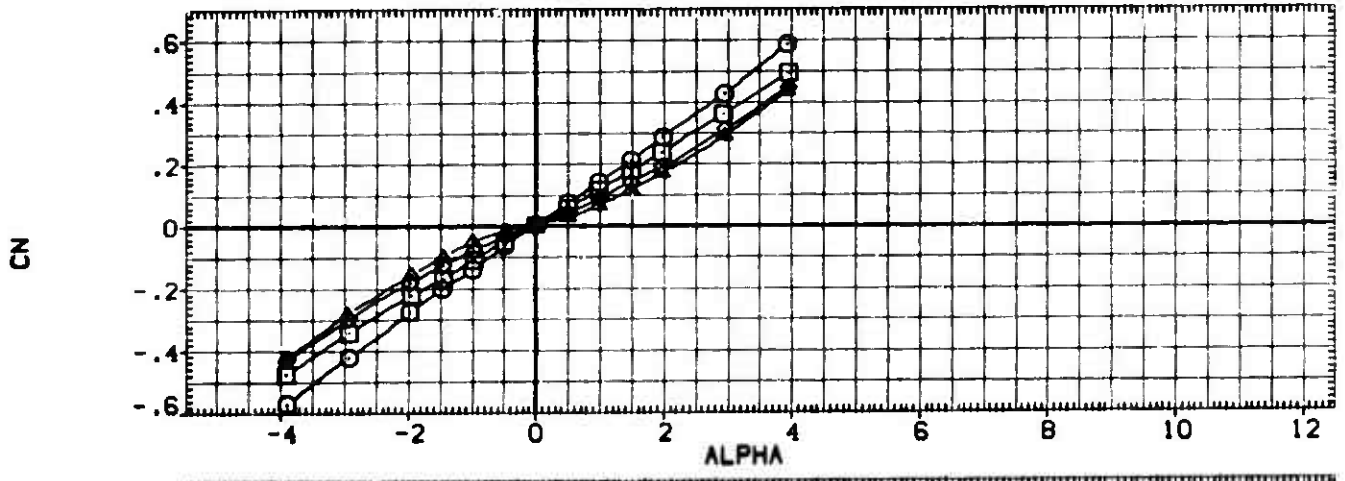
THRUST EFFECTS ON STABILITY CHARACTERISTICS

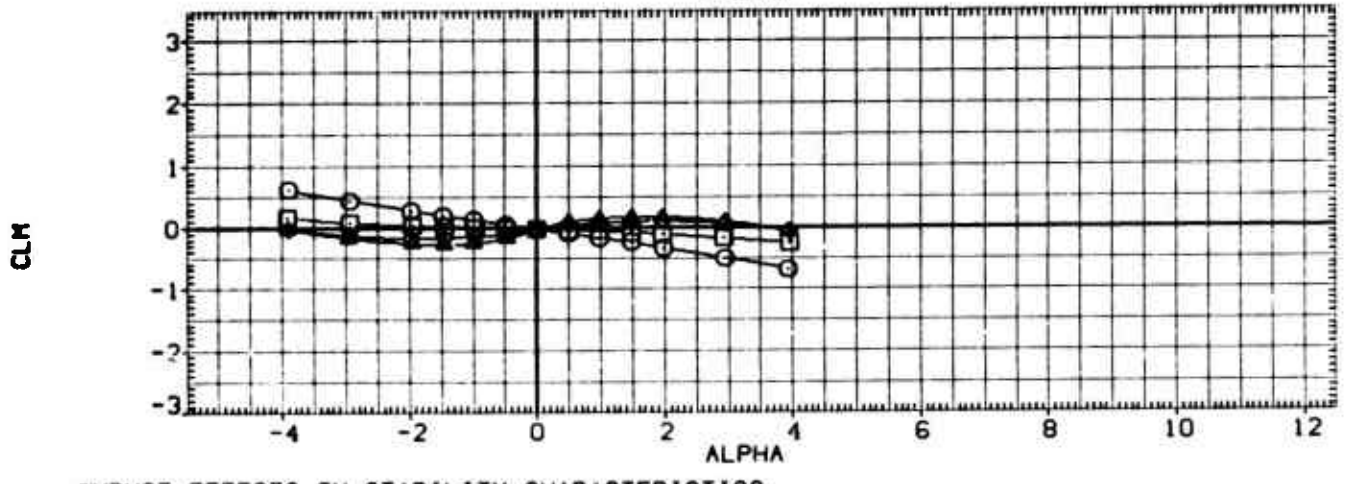
AEDC TF360 BODY FIN. BF1 (RXE014)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.010	BETA	.000	PHI	.000
□	2.011	FINPOS	3.000	MACH	1.500
◇	3.012				
△	4.017				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	





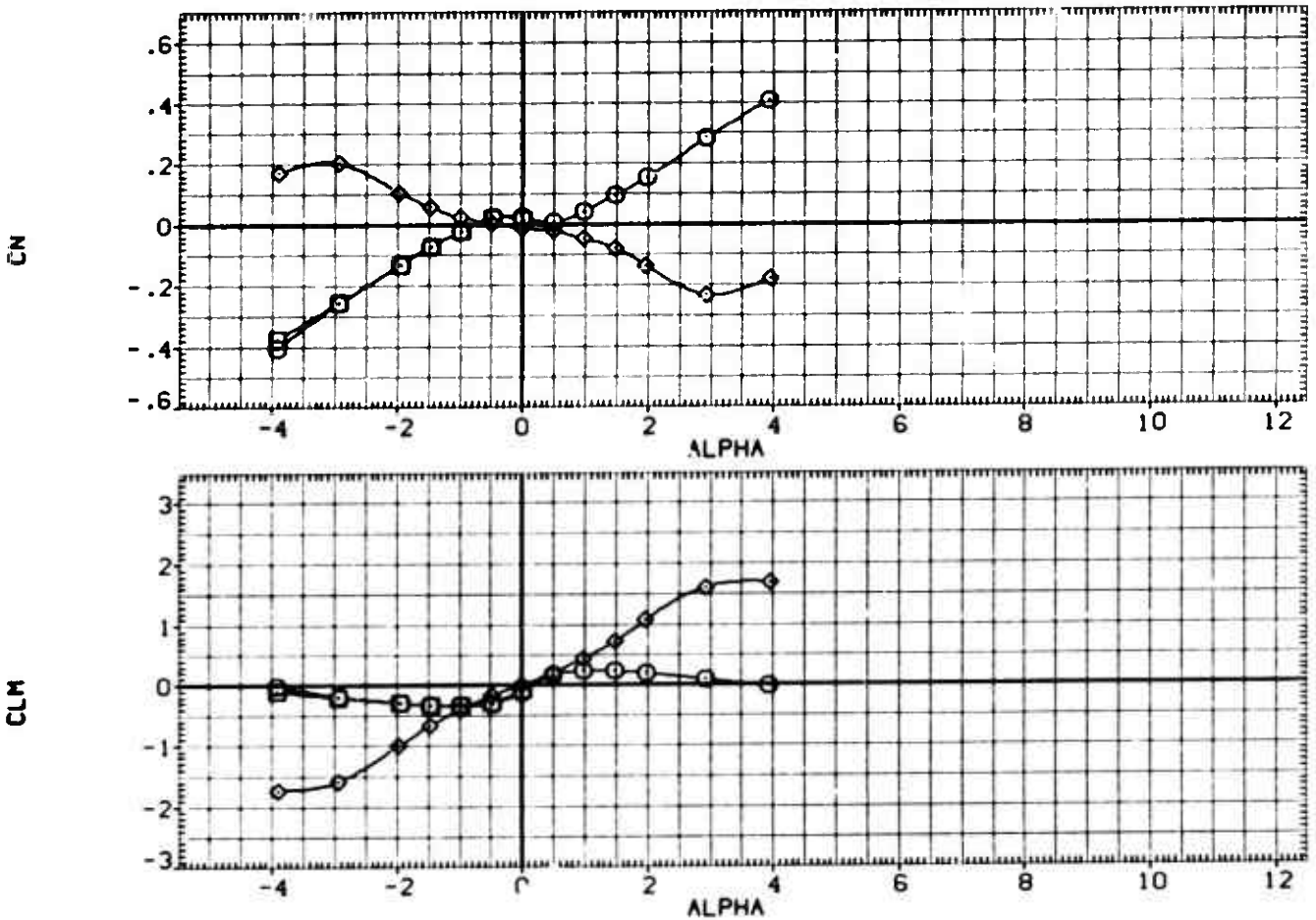
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN, BF1 (RXE014)

SYMBOL	CRT		PARAMETRIC VALUES		
○	5.999	BETA	.000	PHI	.000
□	6.547	FINPOS	3.000	MACH	1.500
◇	11.962				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC SF172 BODY FIN, BF1 (RXE015)

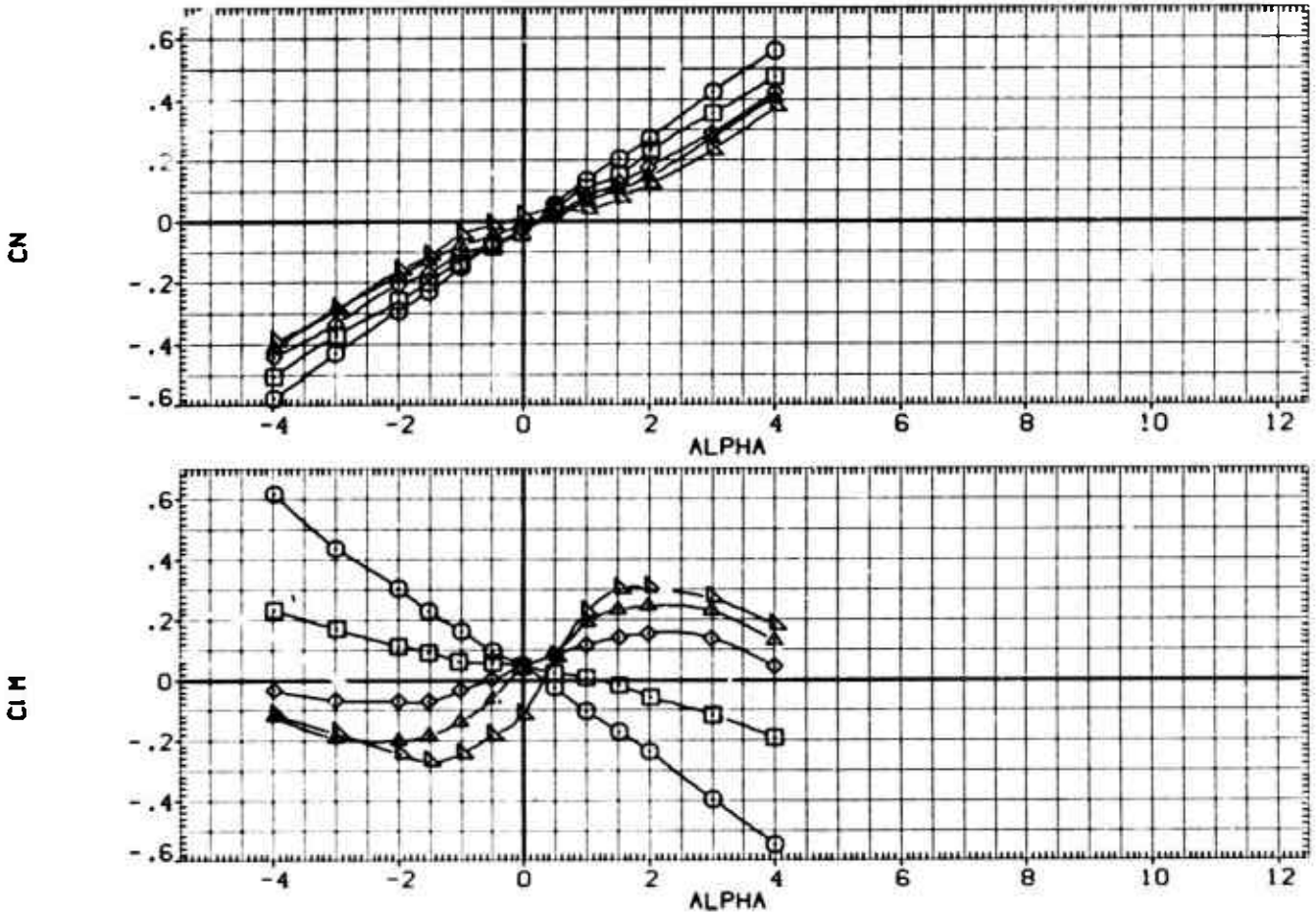
SYMBOL	CRT
□	.021
△	1.954
◇	3.018
▽	4.018
▷	5.959

PARAMETRIC VALUES

BETA	.000	PHI	.000
FINPOS	3.000	MACH	1.700

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	2E.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC SF172 BODY FIN. BF1 (RXE016)

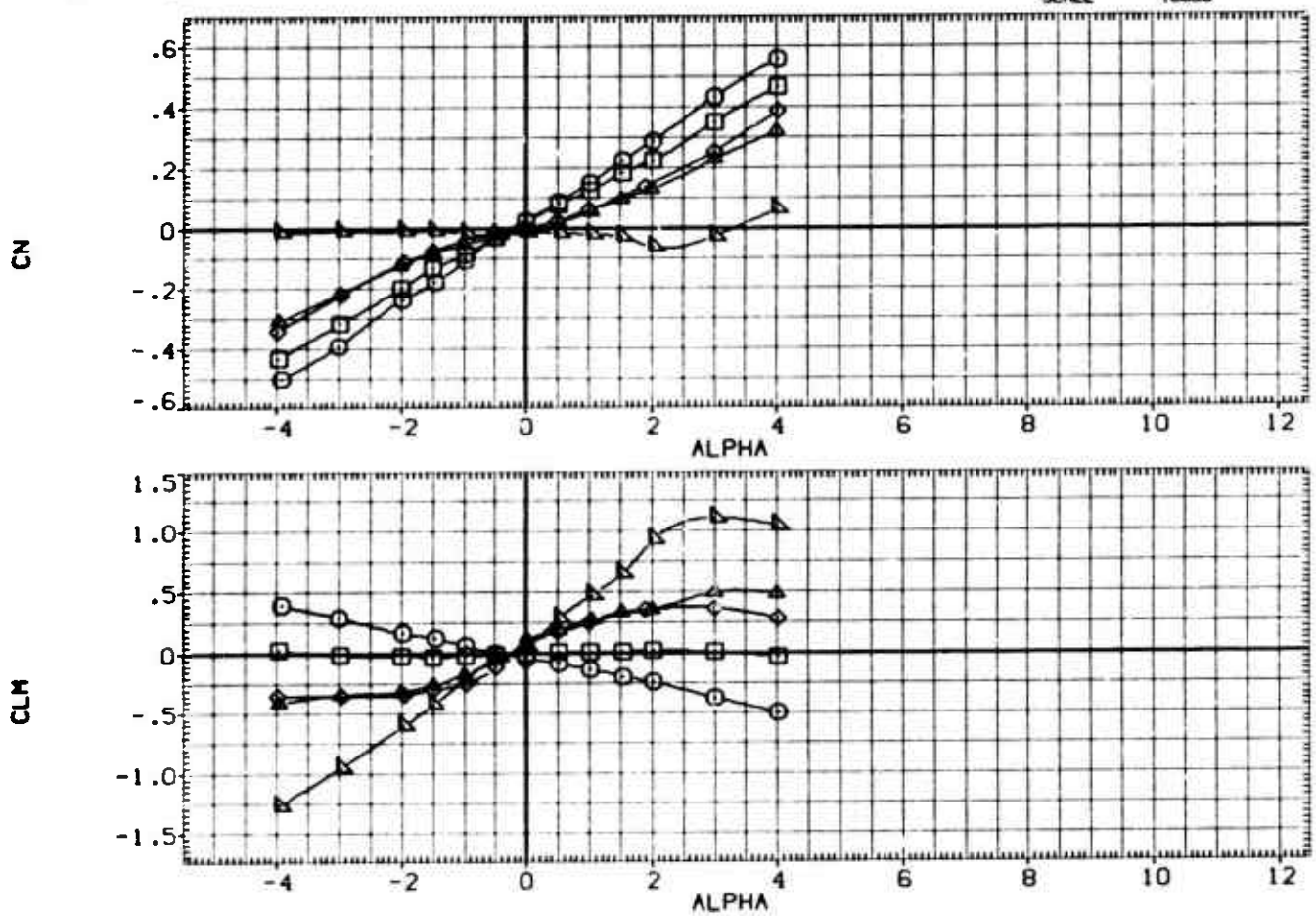
SYMBOL	CRT
○	-.000
□	2.011
◇	3.999
△	6.009
▷	11.932

PARAMETRIC VALUES

BETA	.000	PHI	.000	
FINPOS	3.000	MACH	2.000	

REFERENCE INFORMATION

SREF	19.6350	SQ. IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC SF172 BODY FIN. BF1 (RXE017)

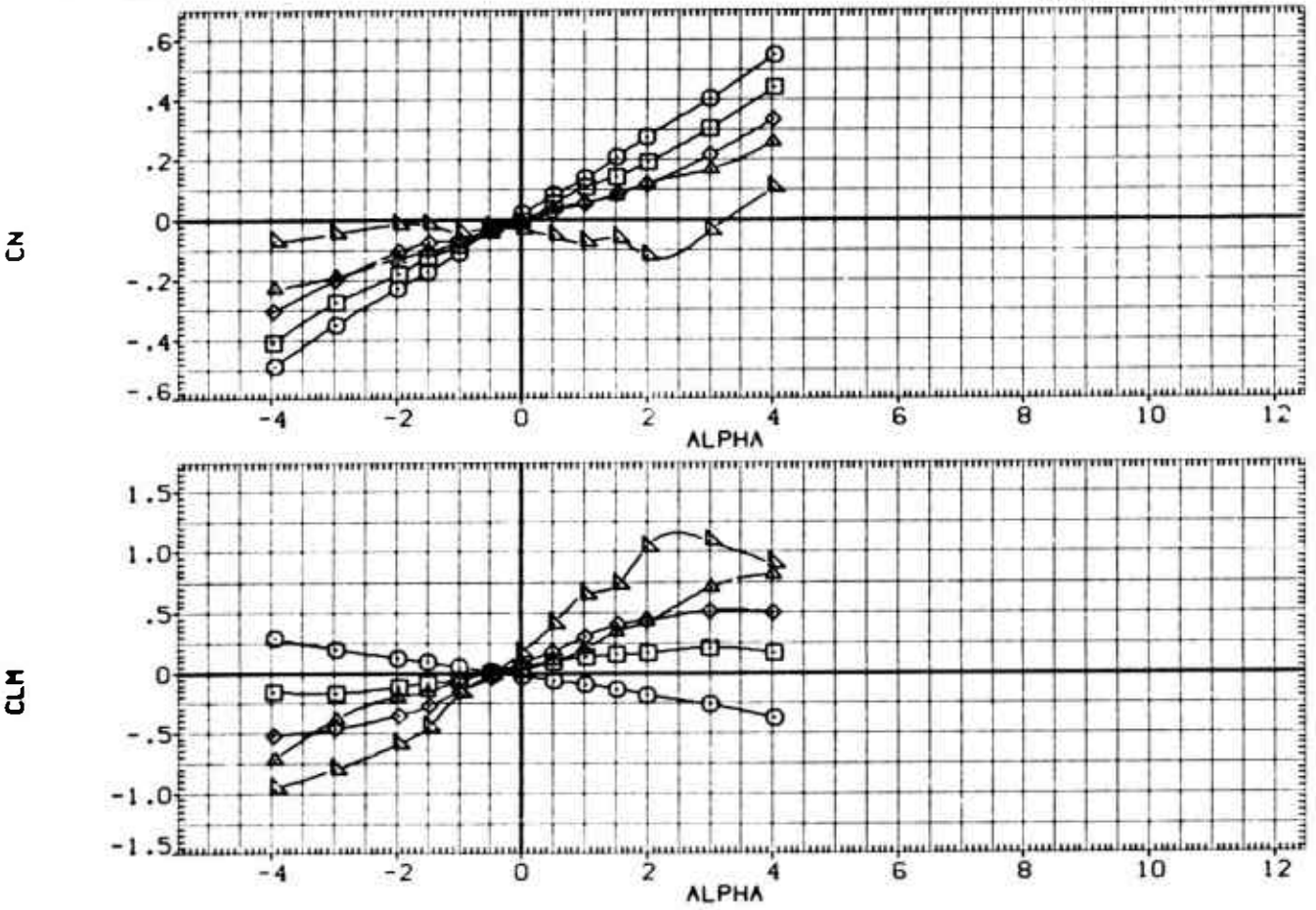
SYMBOL	CRT
○	.021
□	2.024
◇	4.021
△	6.052
◁	12.011

PARAMETRIC VALUES

BETA	.000	PHI	.000	
FINPOS	3.000	MACH	2.300	

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

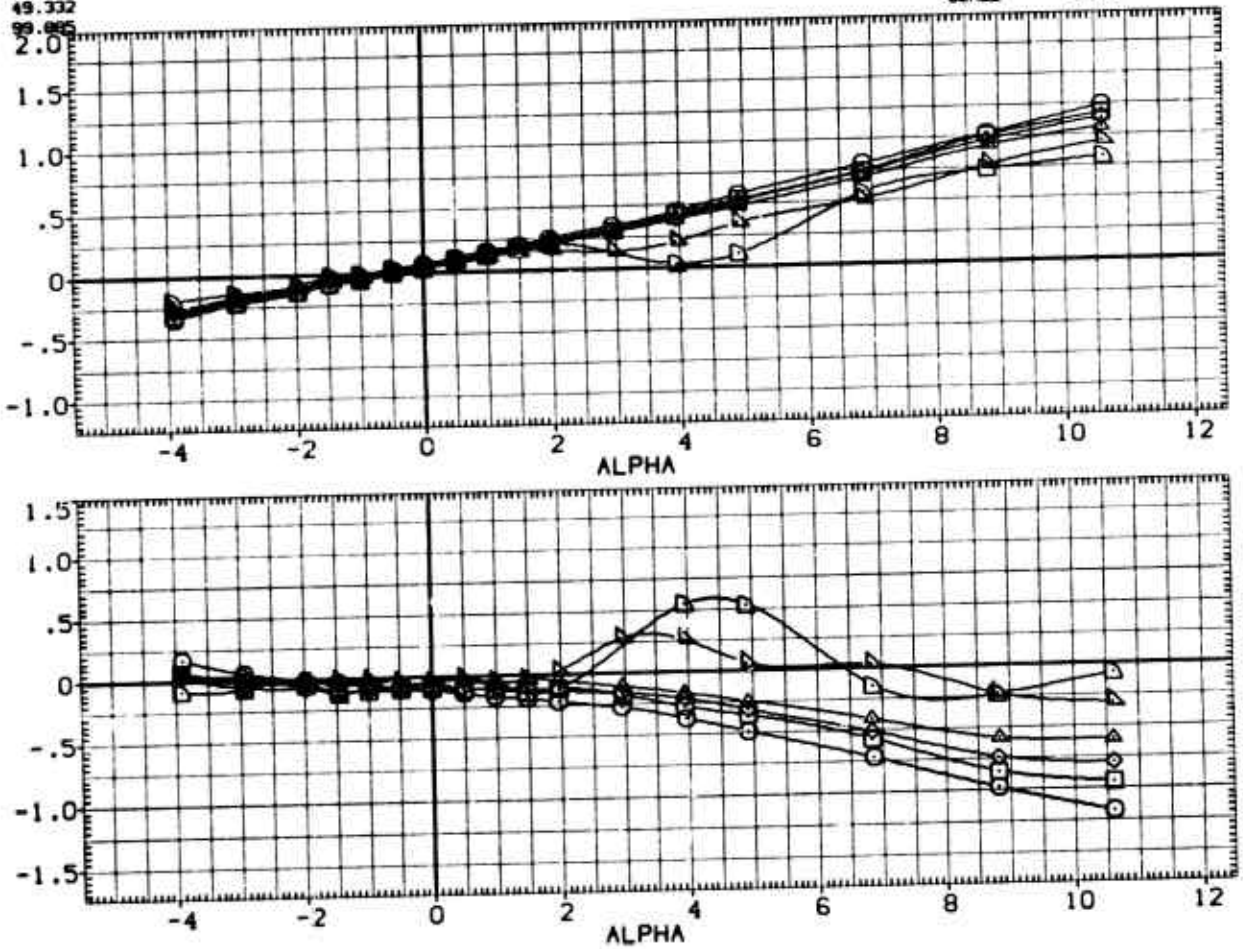
AEDC TF360 BODY FIN, BF2 (RXE018)

PARAMETRIC VALUES

SYMBOL	CNT				
◇	.542	BETA	.000	PHI	.000
□	5.253	FINPOS	3.000	MACH	.200
△	12.314				
○	25.314				
	49.332				
	99.885				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



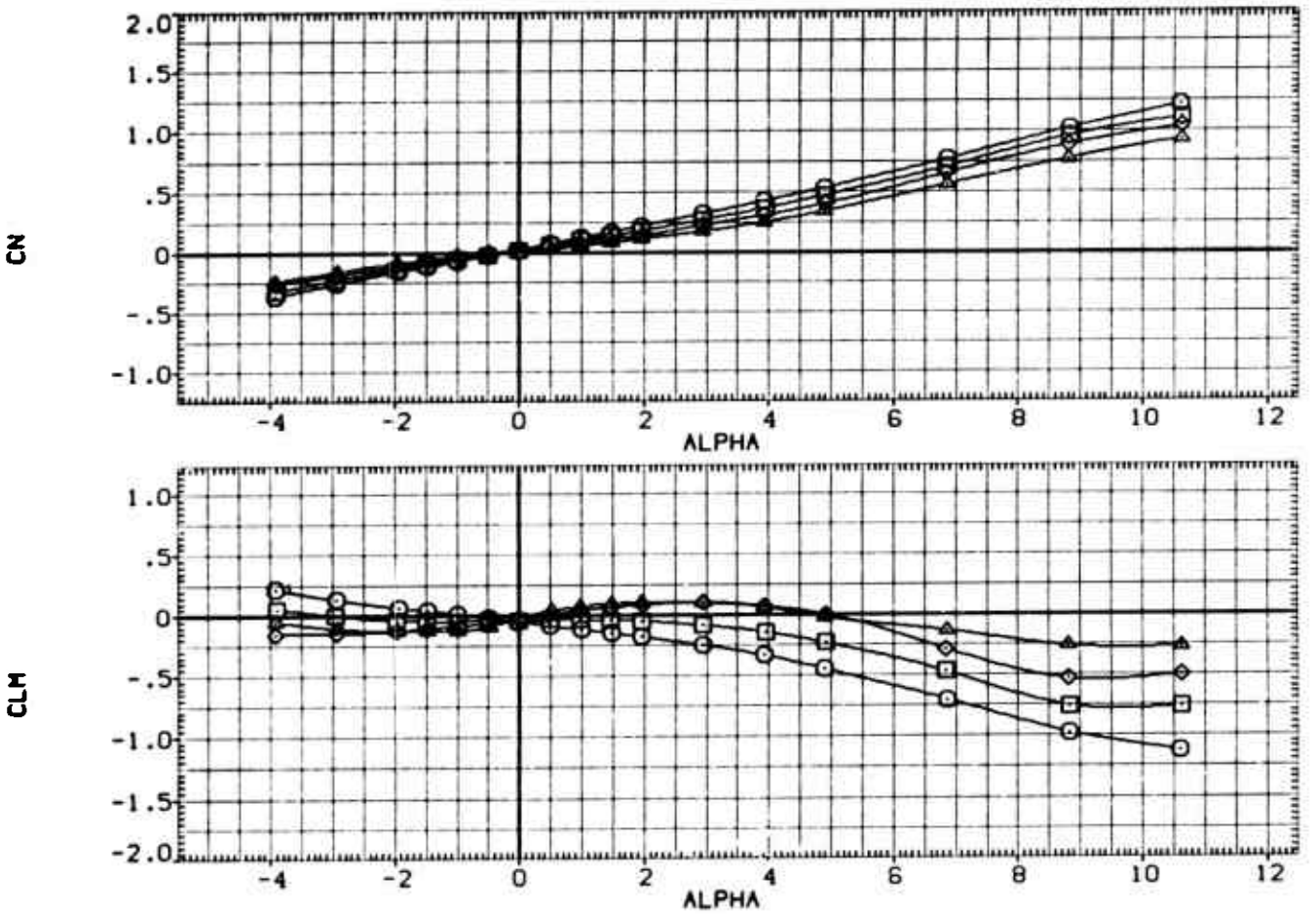
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN. BF2 (RXE019)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.120	BETA	.000	PHI	.000
◇□	5.713	FINPOS	3.000	MACH	.400
▽	12.135				
△	37.274				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



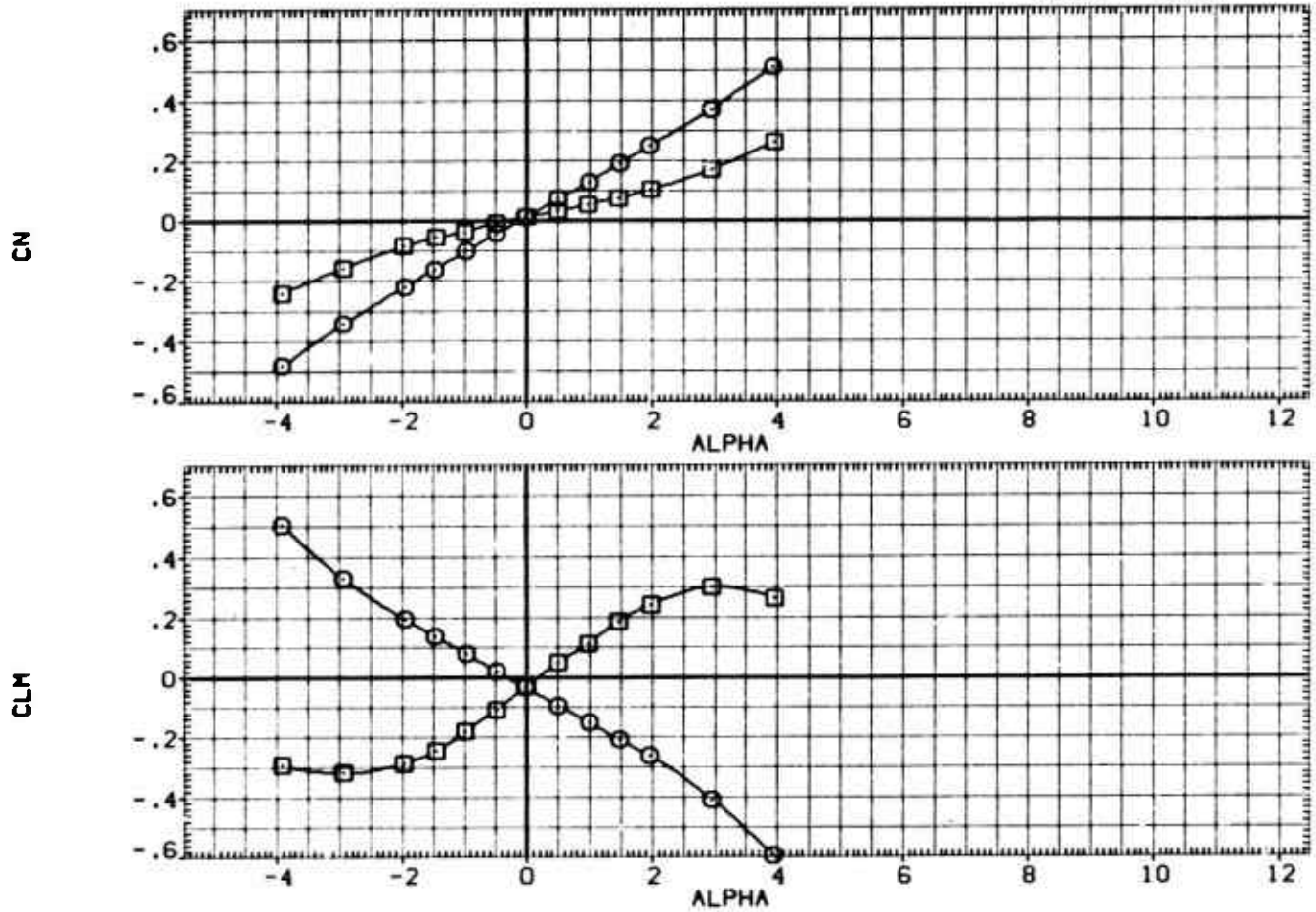
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN, BF2 (RXE020)

SYMBOL	CRT		PARAMETRIC VALUES		
□	.010	BETA	.000	PHI	.000
□	5.990	FINPOS	3.000	MACH	1.000

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



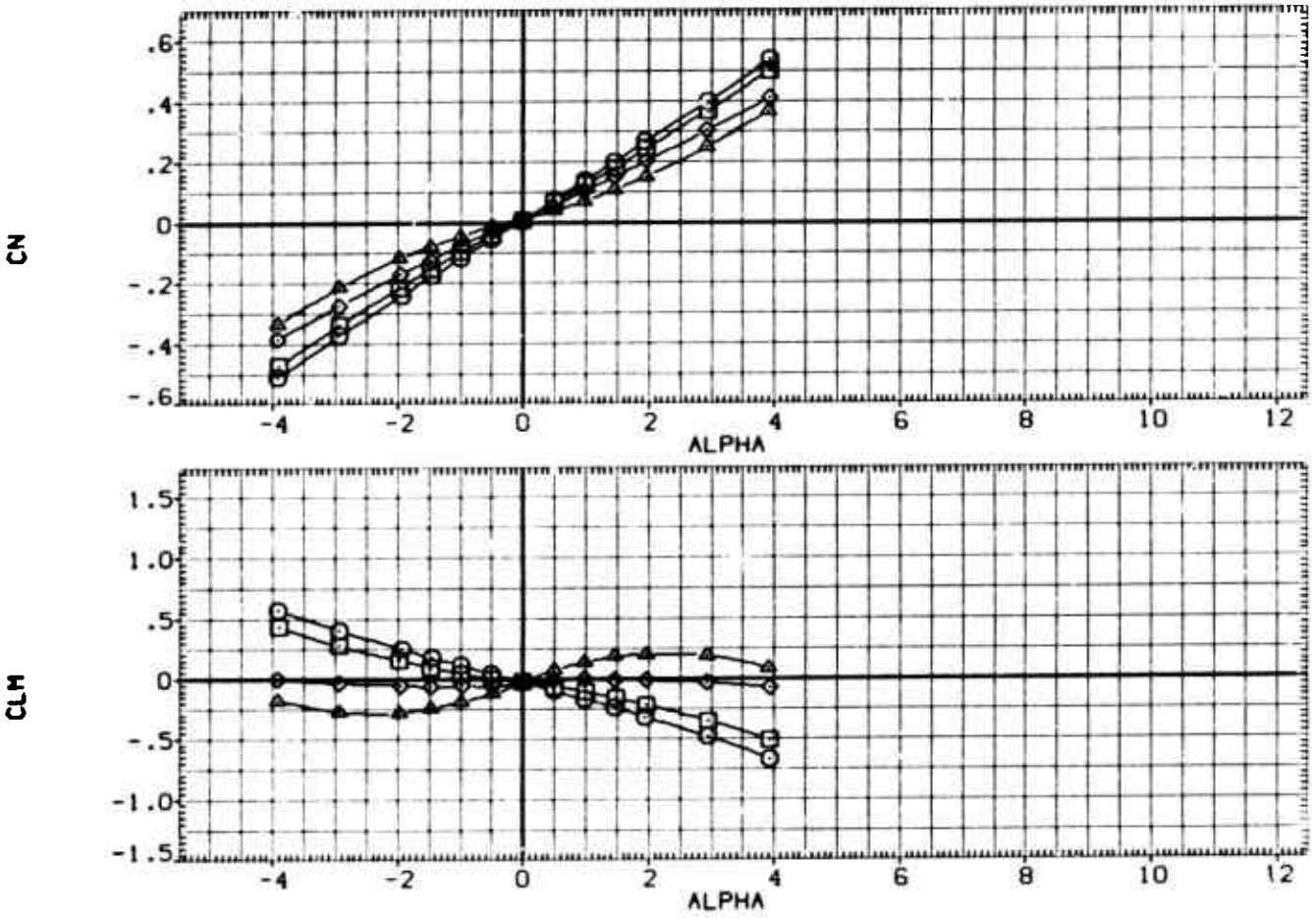
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN, BF2 (RXE021)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.010	BETA	.000	PHI	.000
□	.694	FINPOS	3.000	MACH	1.250
◇	2.016				
△	3.015				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



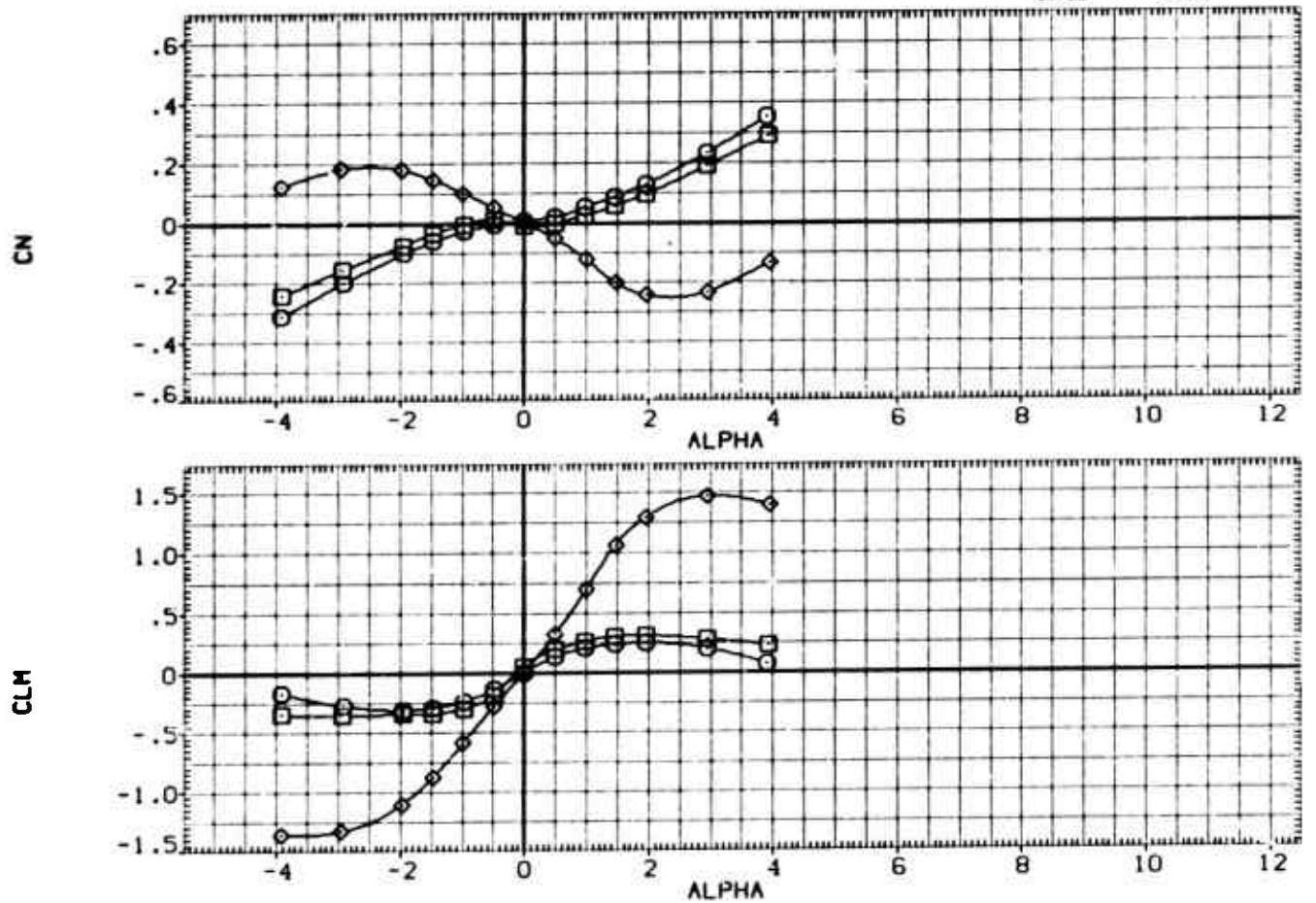
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN, BF2 (RXE021)

SYMBOL	CRT		PARAMETRIC VALUES		
○	4.006	BETA	.000	PHI	.000
□	6.010	FINPOS	3.000	MACH	1.250
◇	11.905				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



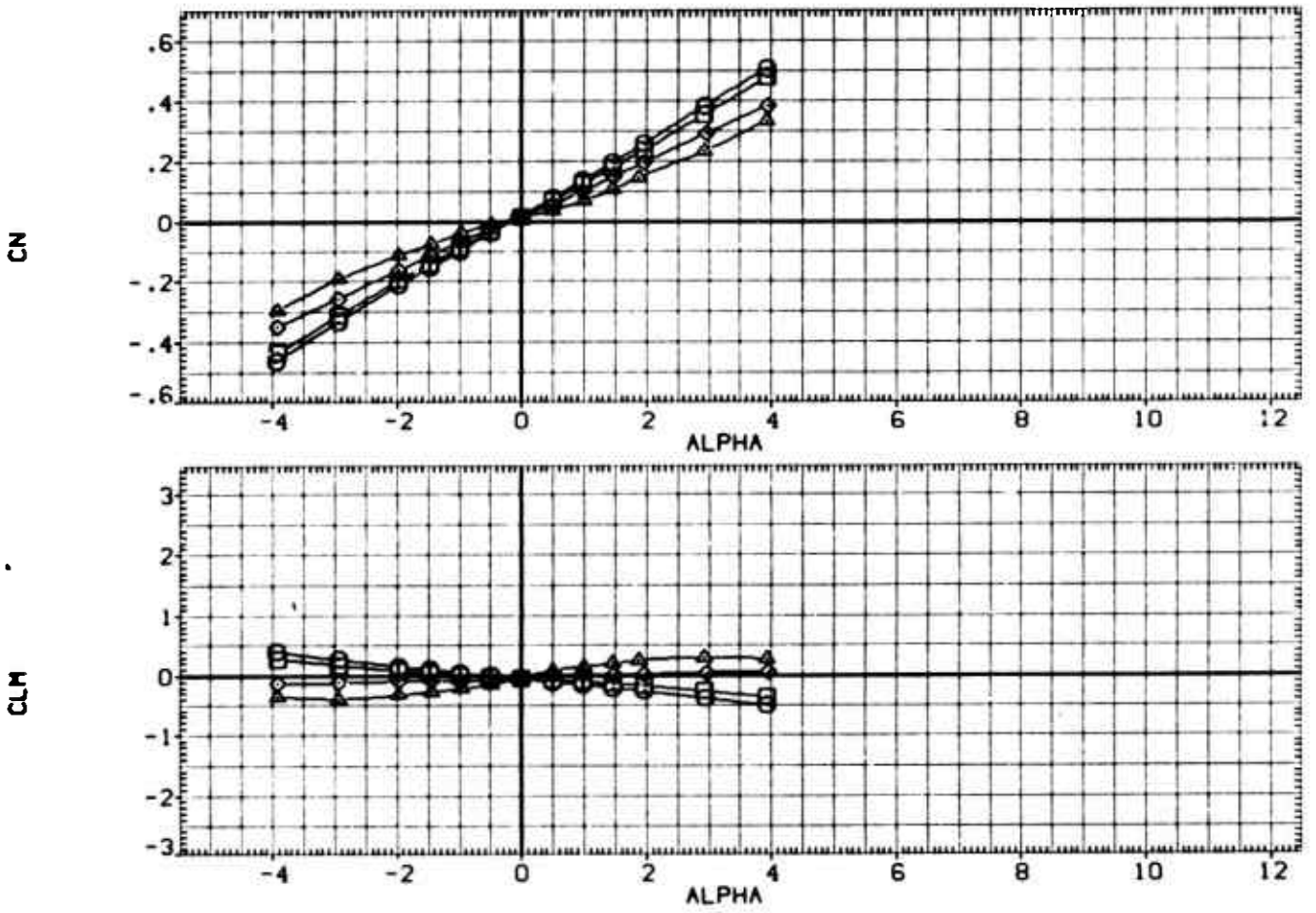
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN. BF2 (RXE022)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.010	BETA	.000	PHI	.000
□	.989	FINPOS	3.000	MACH	1.500
◇	2.008				
△	3.060				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



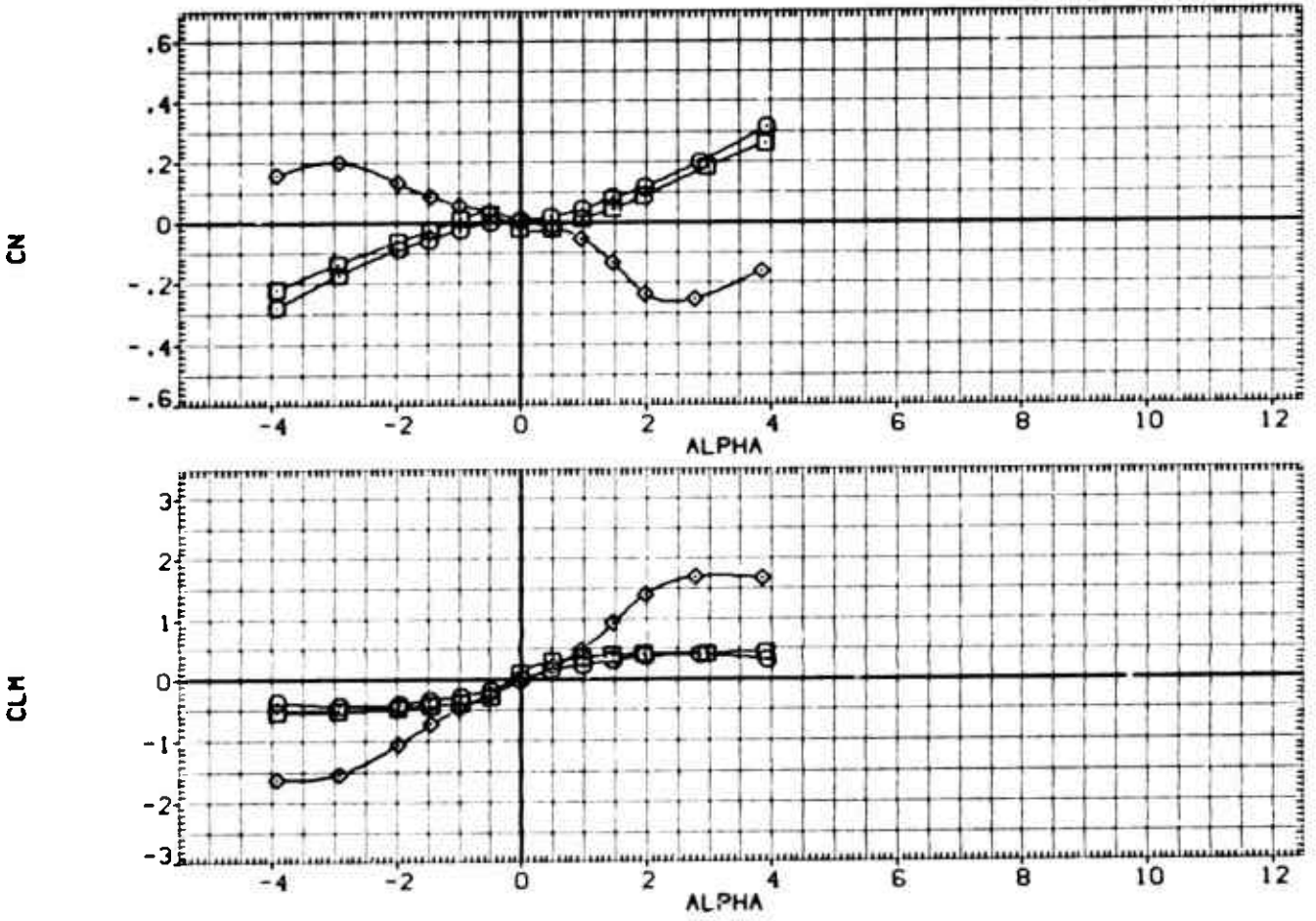
THRUST EFFECTS ON STABILITY CHARACTERISTICS

AEDC TF360 BODY FIN. BF2 (RXE022)

SYMBOL	CRT		PARAMETRIC VALUES		
◇	4.000	BETA	.000	PHI	.000
□	5.500	FINPOS	3.000	MACH	1.500
○	11.851				

REFERENCE INFORMATION

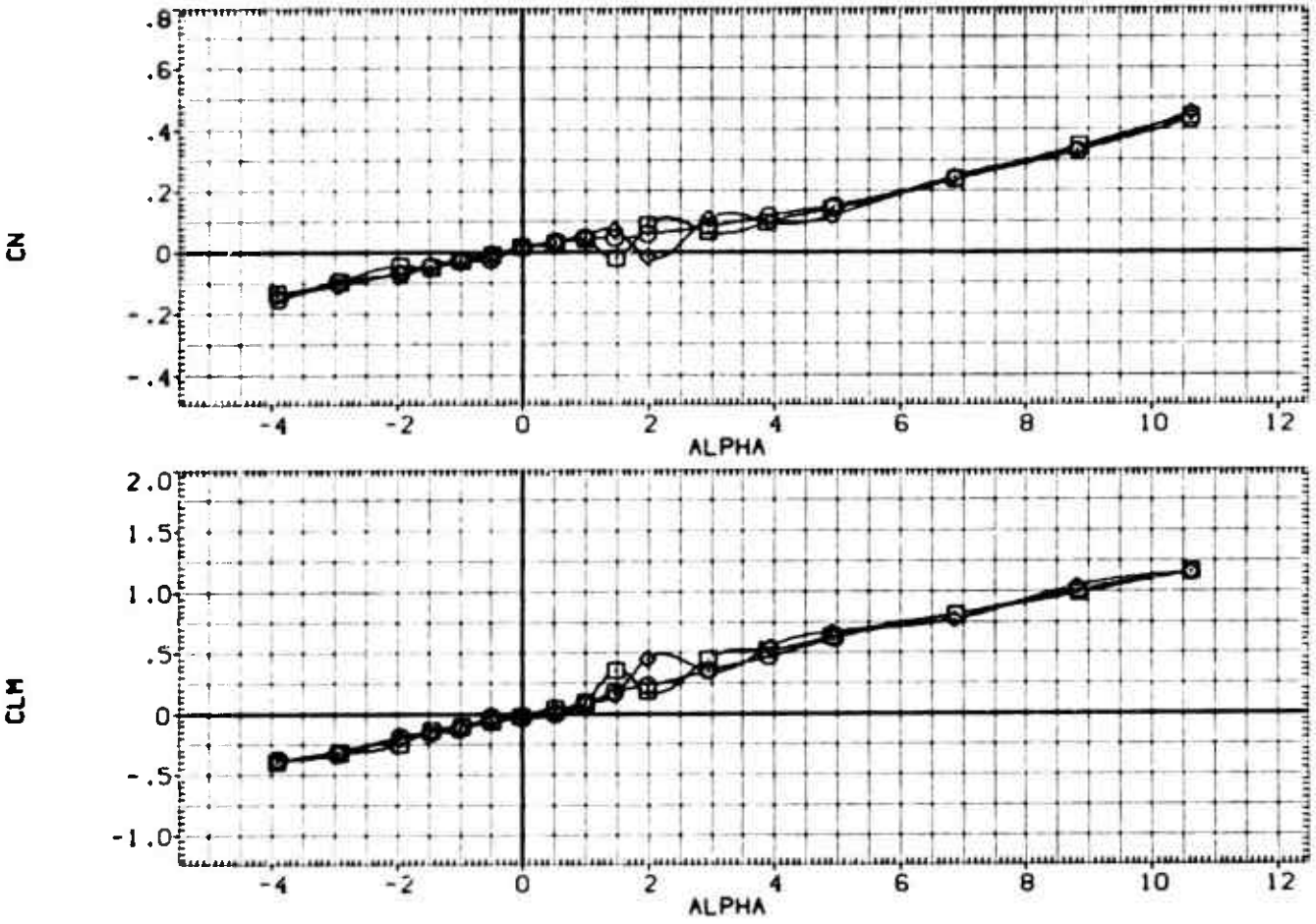
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON STABILITY CHARACTERISTICS

DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	MACH
(BAE002)	○	AEDC TF360 BODY ALONE.B(INCREASING ALPHA)	.000	.000	.200
(BAE023)	□	AEDC TF360 BODY ALONE.B(DECREASING ALPHA)	.000	.000	.200
(BAE024)	◇	AEDC TF360 BODY ALONE.B(INCREASING ALPHA)	.000	.000	.200

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	

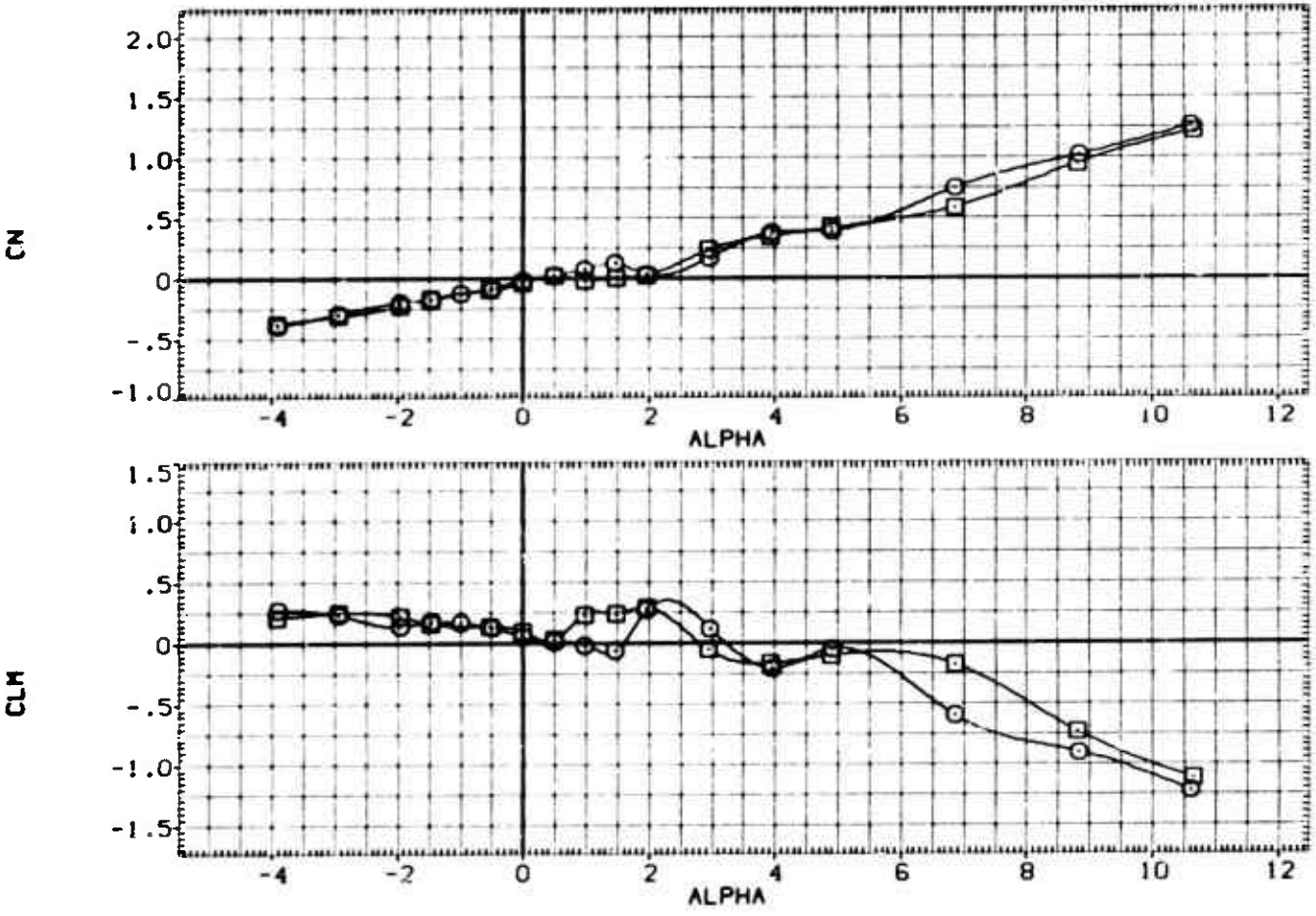


HYSTERESIS EFFECTS

(A)CRT = 50.61

DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	FINOS	MACH
(BWE009)		AEDC TF360 BODY FIN, BF1(INCREASING ALPHA)	.000	.000	3.000	.200
(BWE025)		AEDC TF360 BODY FIN, BF1(DECREASING ALPHA)	.000	.000	3.000	.200

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5700	IN.
YMRP	.0030	IN.
ZMRP	.0060	IN.
SCALE	.0000	

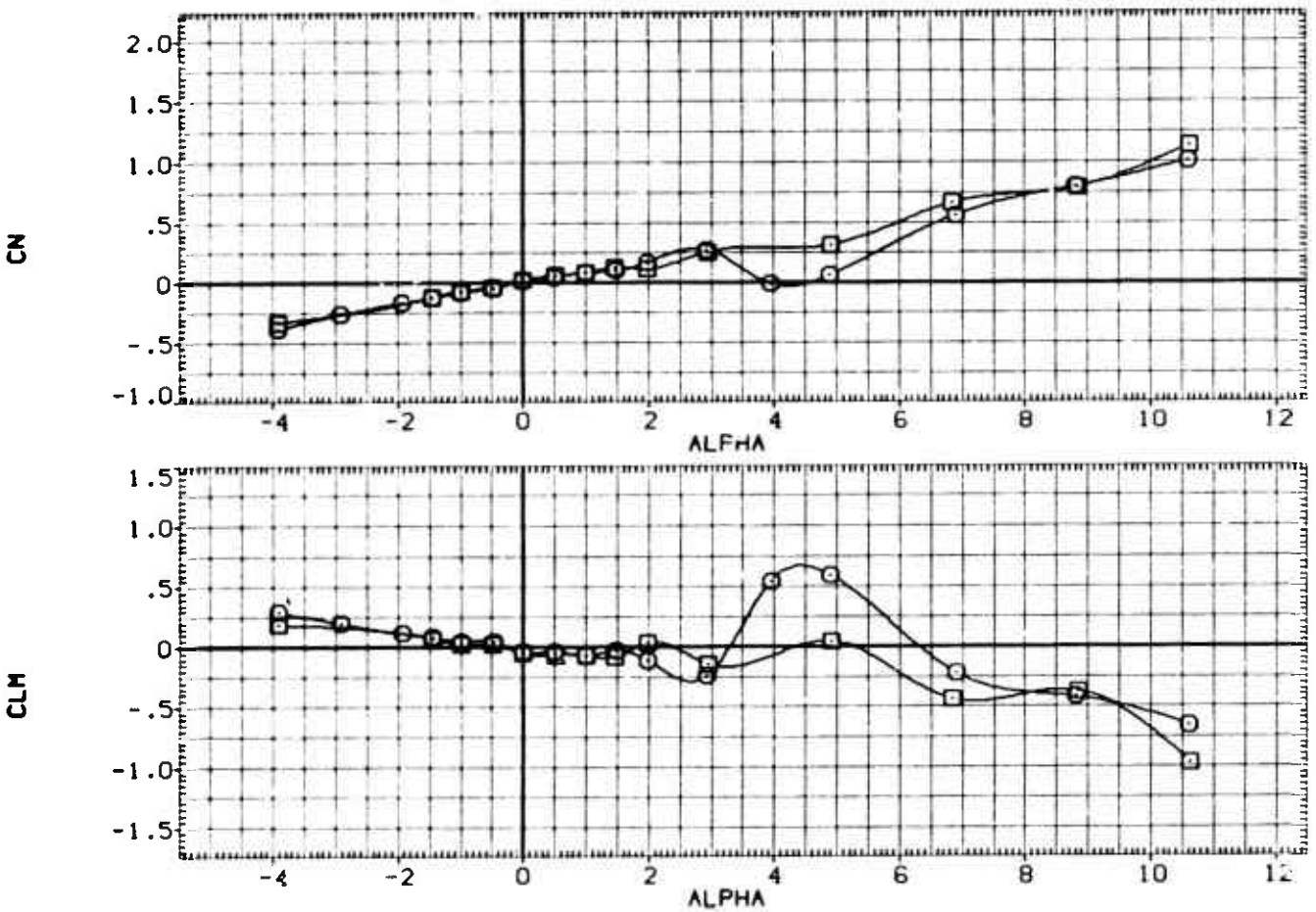


HYSTERESIS EFFECTS

(A)CRT = 50.14

DATA SET SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	FINPOS	MACH
(BXE009) ○	AEDC TF360 BODY FIN. BF1(INCREASING ALPHA)	.000	.000	3.000	.200
(BXE025) □	AEDC TF360 BODY FIN. BF1(DECREASING ALPHA)	.000	.000	3.000	.200

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



HYSTERESIS EFFECTS

(B)CRT =100.92

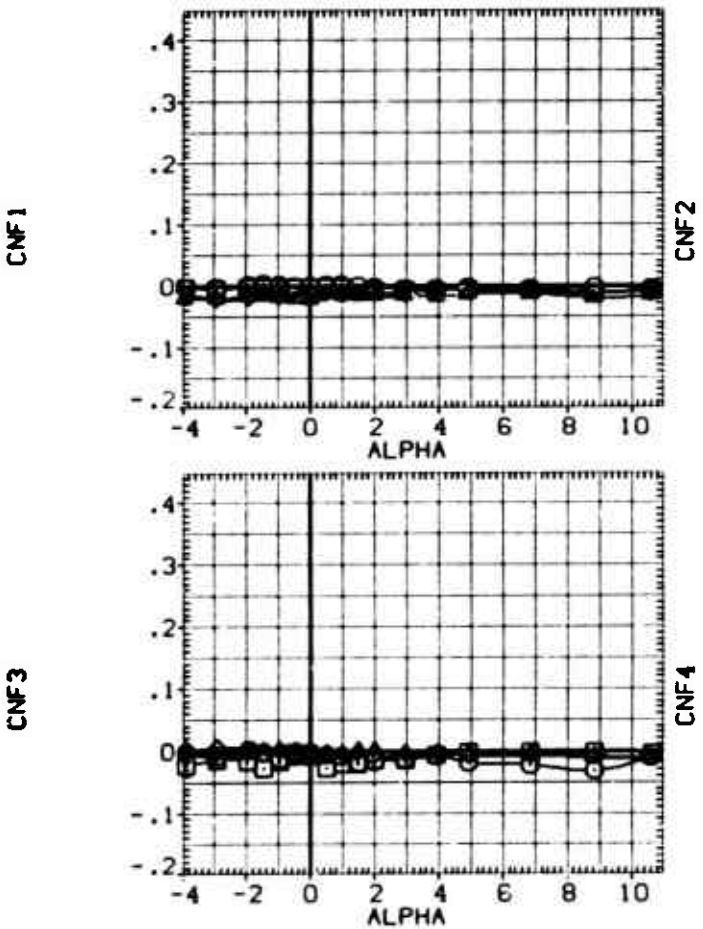
AEDC TF360 BODY FIN. BF1

(RXE109)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.575	BETA	.000	PHI	.000
□	26.074	FINPOS	5.000	MACH	.200
◇	50.139				
△	100.918				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



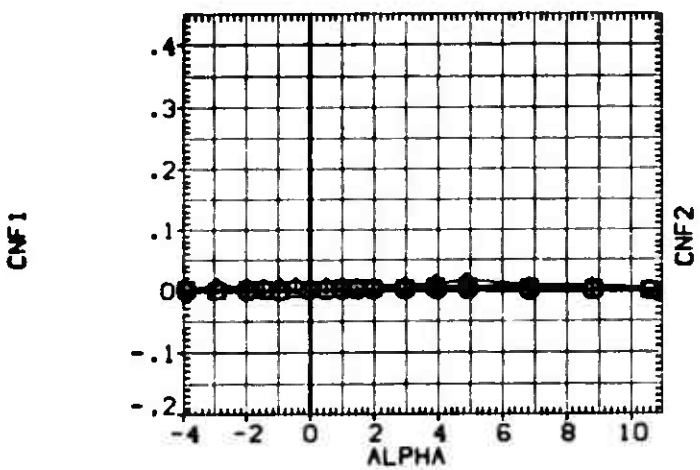
THRUST EFFECTS ON FIN NORMAL FORCE

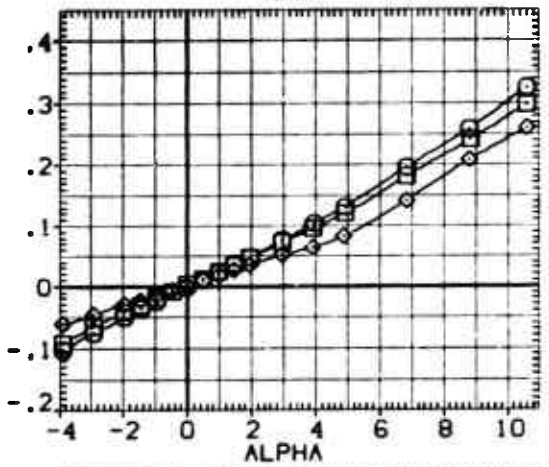
AEDC TF360 BODY FIN, BF1 (RXE111)

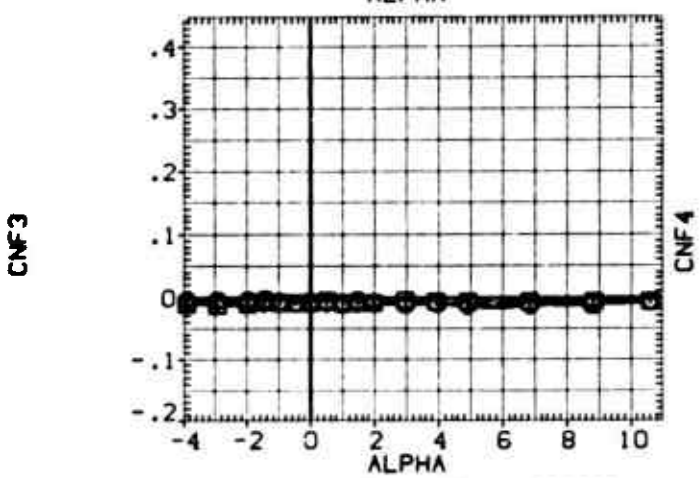
SYMBOL	CRT		PARAMETRIC VALUES		
○	.132	BETA	.000	PHI	.000
□	11.877	FINPOS	3.000	MACH	.400
◇	37.520				

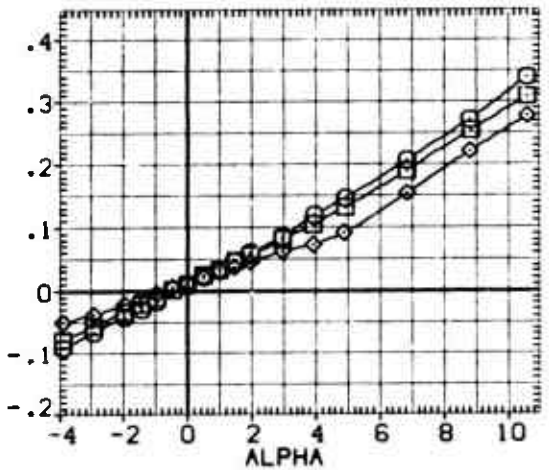
REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	20.0000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	









THRUST EFFECTS ON FIN NORMAL FORCE

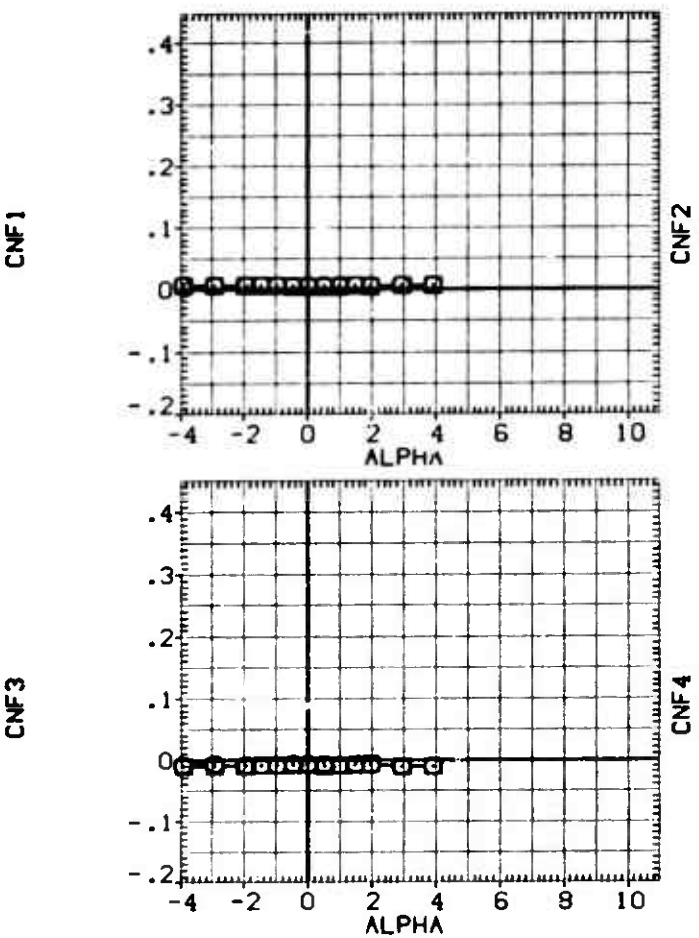
AEDC TF360 BODY FIN, BF1

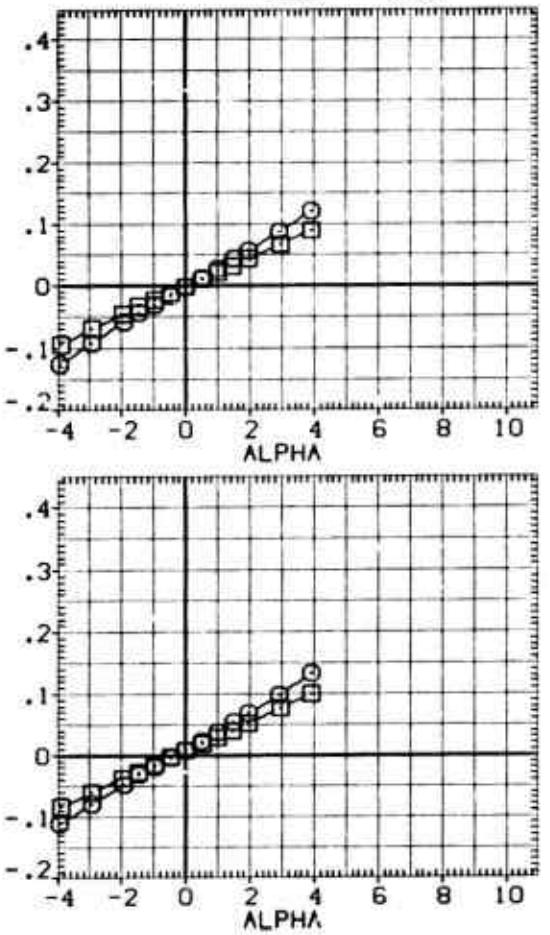
(RXE112)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.012	BETA	.000	PHI	.000
□	5.885	FINPOS	3.000	MACH	1.000

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



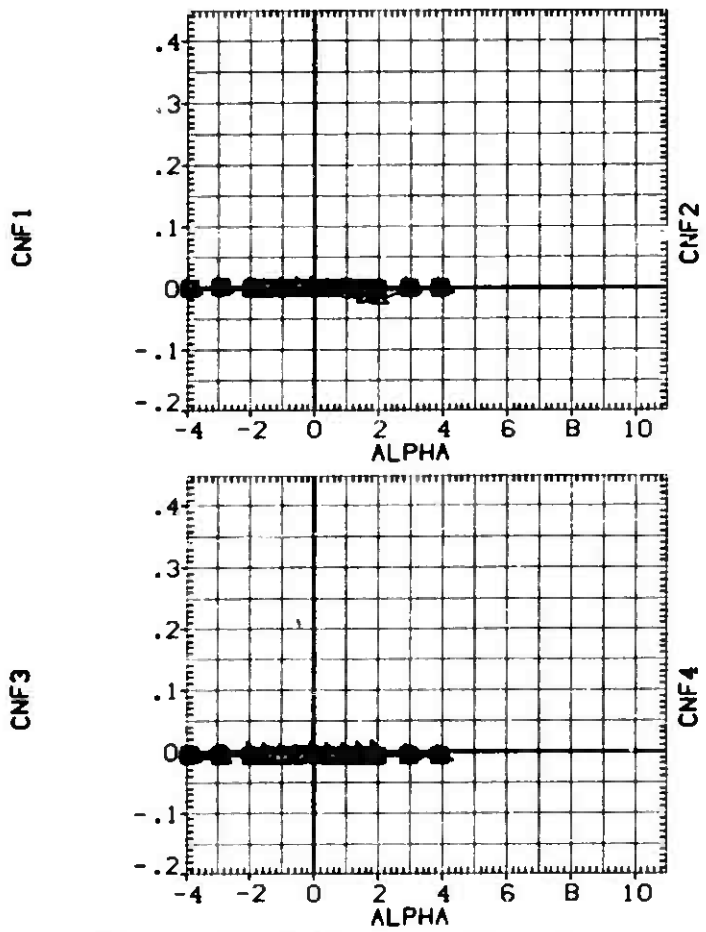


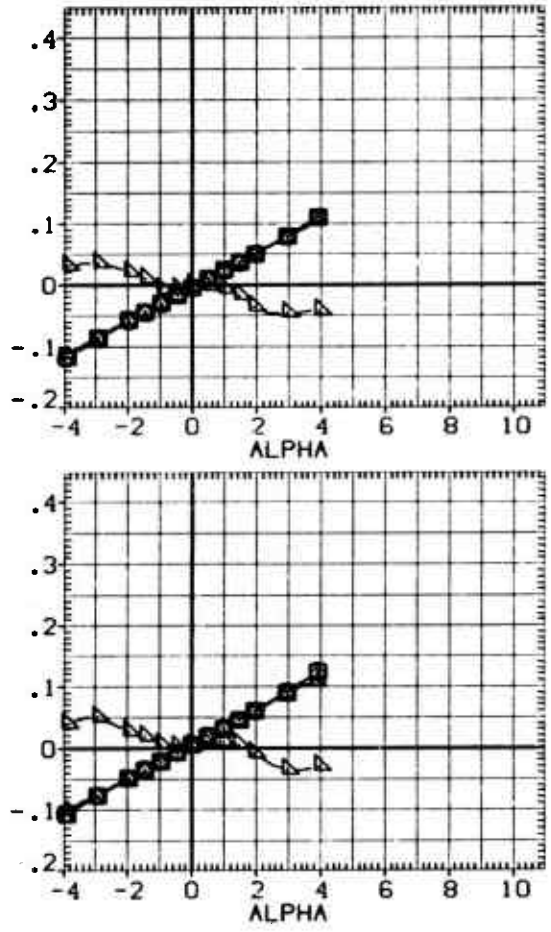
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC TF360 BODY FIN, BF1 (RXE113)

SYMBOL	CRT	PARAMETRIC VALUES			
○	.010	BETA	.000	PHI	.000
□	3.042	FINPOS	3.000	MACH	1.250
◇	4.014				
△	6.006				
◁	11.926				

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	





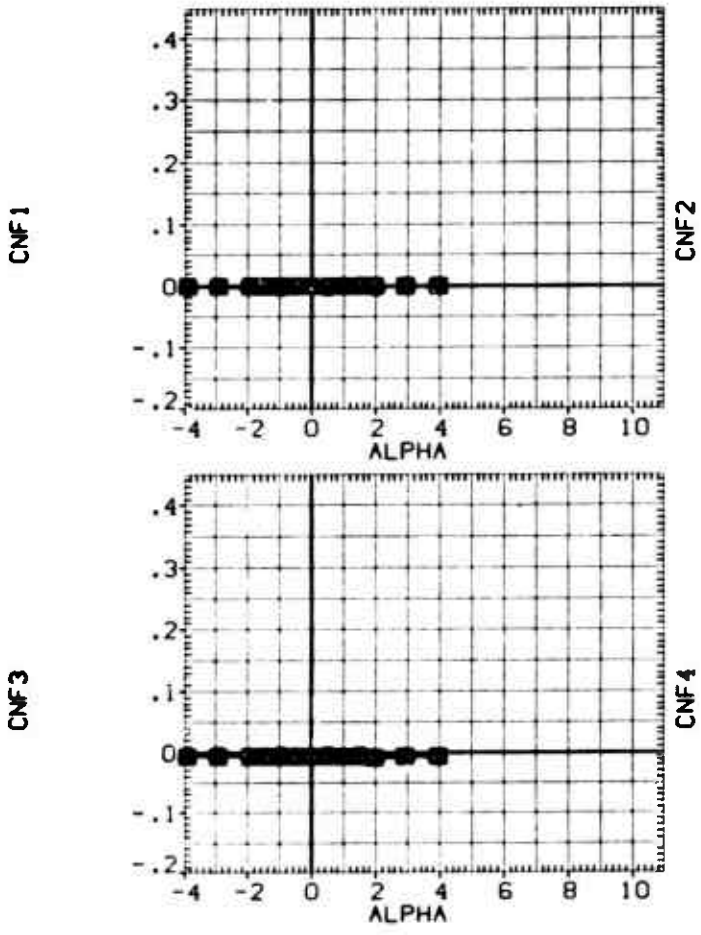
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC TF360 BODY FIN. BF1 (RXE114)

SYMBOL	CRT	PARAMETRIC VALUES			
○	.010	BETA	.000	PHI	.000
□	2.011	FINPOS	3.000	MACH	1.500
◇	3.012				
△	4.017				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



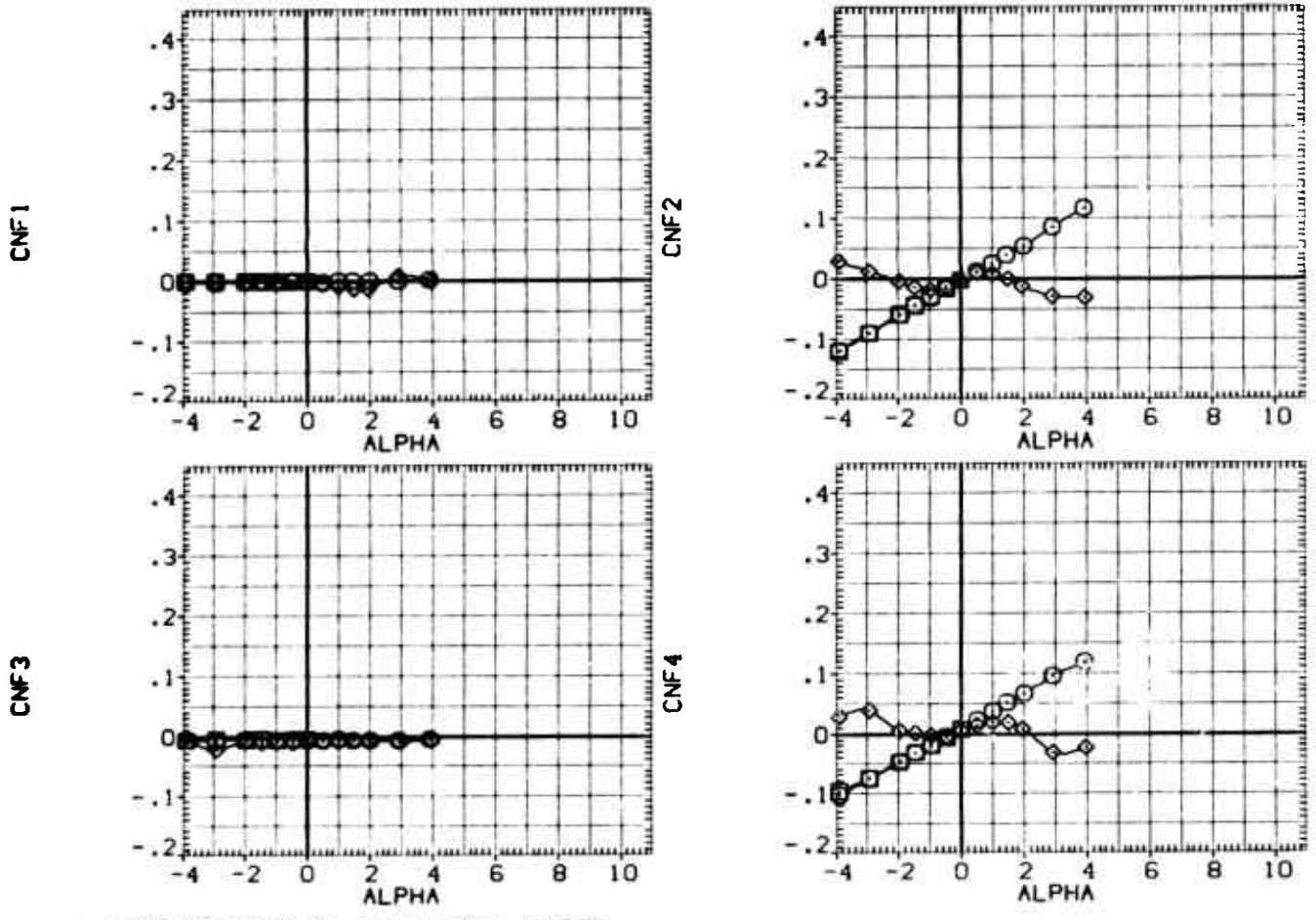
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC TF360 BODY FIN. BF1 (RXE114)

SYMBOL	CRT		PARAMETRIC VALUES		
○	5.999	BETA	.000	PHI	.000
□	6.547	FINPOS	3.000	MACH	.500
◇	11.962				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON FIN NORMAL FORCE

AEDC SF172 BODY FIN. BF1 (RXE115)

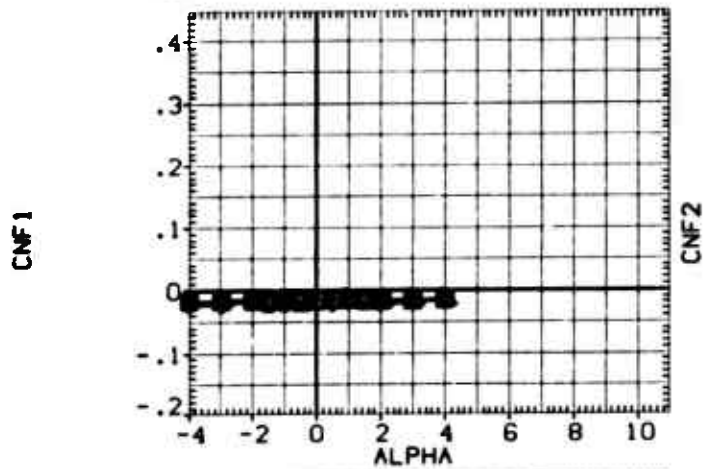
SYMBOL	CRT
○	.021
□	1.954
◇	3.018
▷	4.018
△	5.959

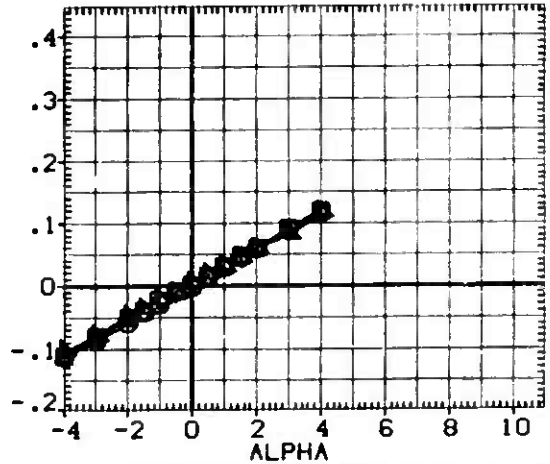
PARAMETRIC VALUES

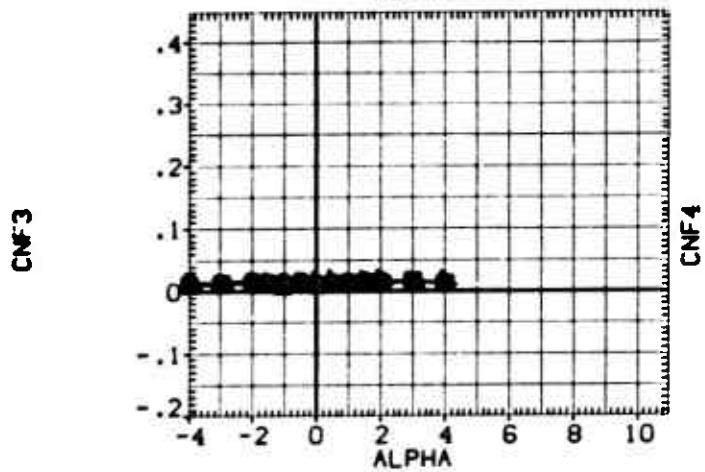
BETA	.000	PHI	.000		
FINPOS	3.000	MACH	1.700		

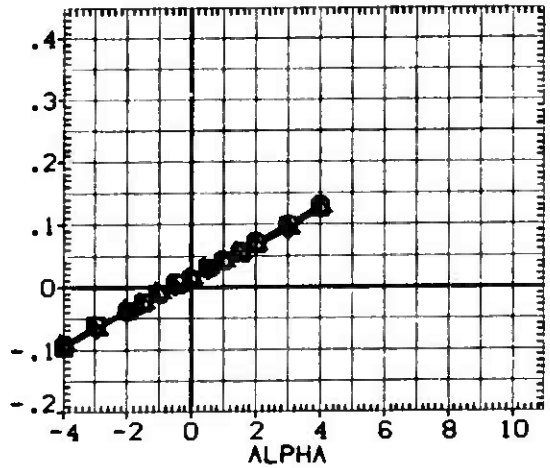
REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	









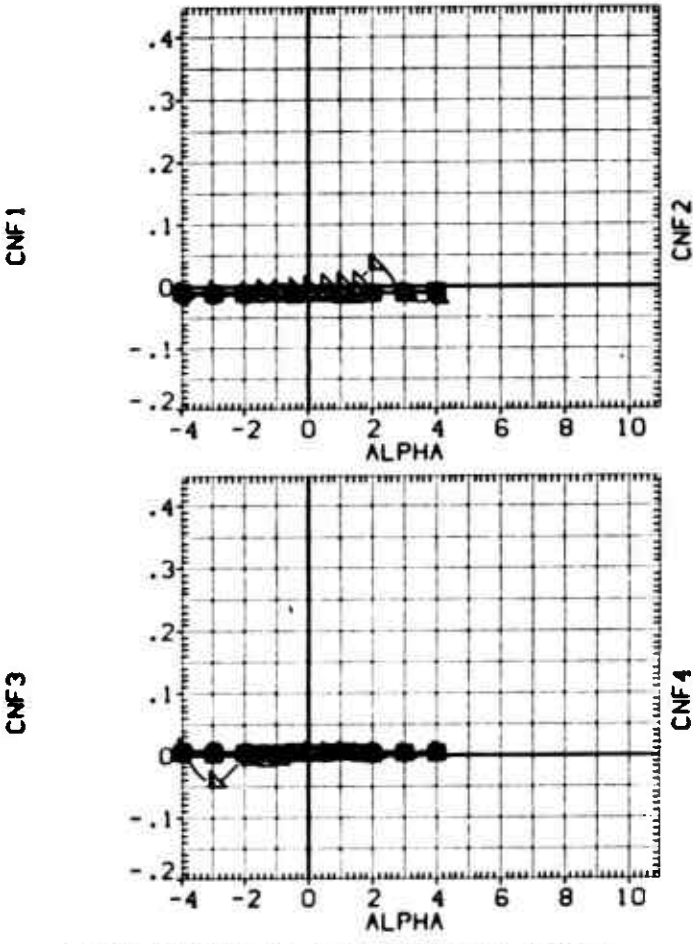
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC SF172 BODY FIN, BF1

(RXE116)

SYMBOL	CAT	PARAMETRIC VALUES			
○	-.000	BETA	.000	PHI	.000
□	2.011	FINPOS	3.000	MACH	2.000
◇	3.989				
△	6.009				
▷	11.932				

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5600	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	

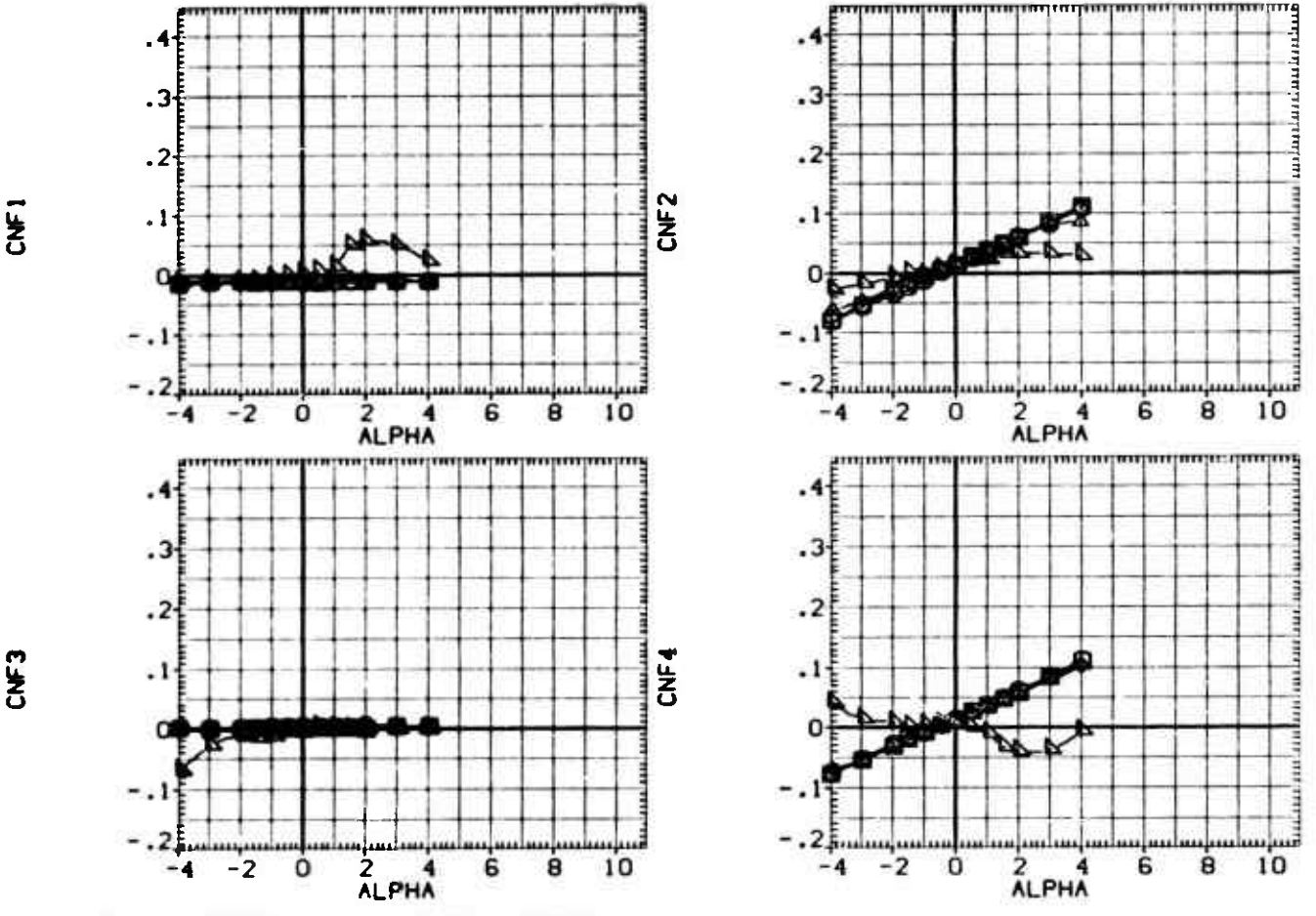


THRUST EFFECTS ON FIN NORMAL FORCE

AEDC SF172 BODY FIN, BF1 (RXE117)

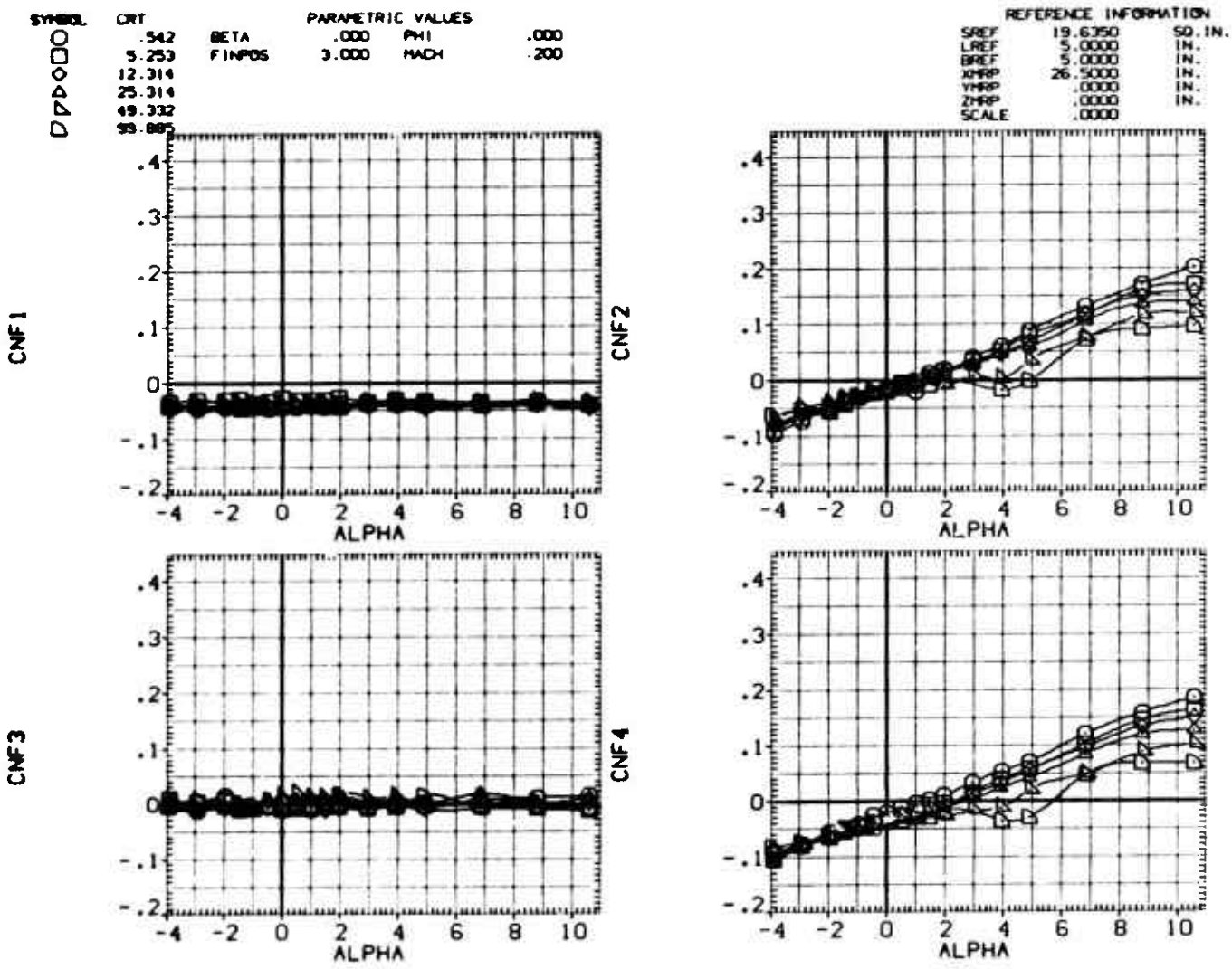
SYMBOL	CRT		PARAMETRIC VALUES		
○	.021	BETA	.000	PHI	.000
□	2.024	FINPOS	3.000	MACH	2.300
◇	4.021				
△	6.052				
▽	12.011				

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON FIN NORMAL FORCE

AEDC TF360 BODY FIN. BF2 (RXE11B)



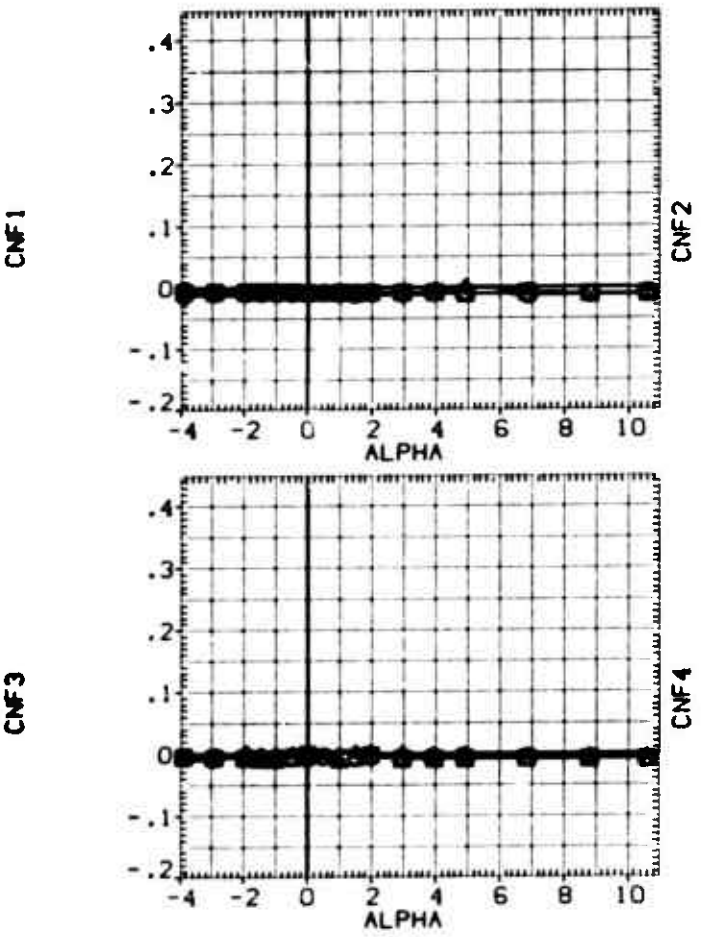
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC TF360 BODY FIN, BF2

(CXE119)

SYMBOL	CRT	PARAMETRIC VALUES			
○	.120	BETA	.000	PHI	.000
□	5.713	FINPOS	3.000	MACH	.400
◇	12.135				
△	37.274				

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



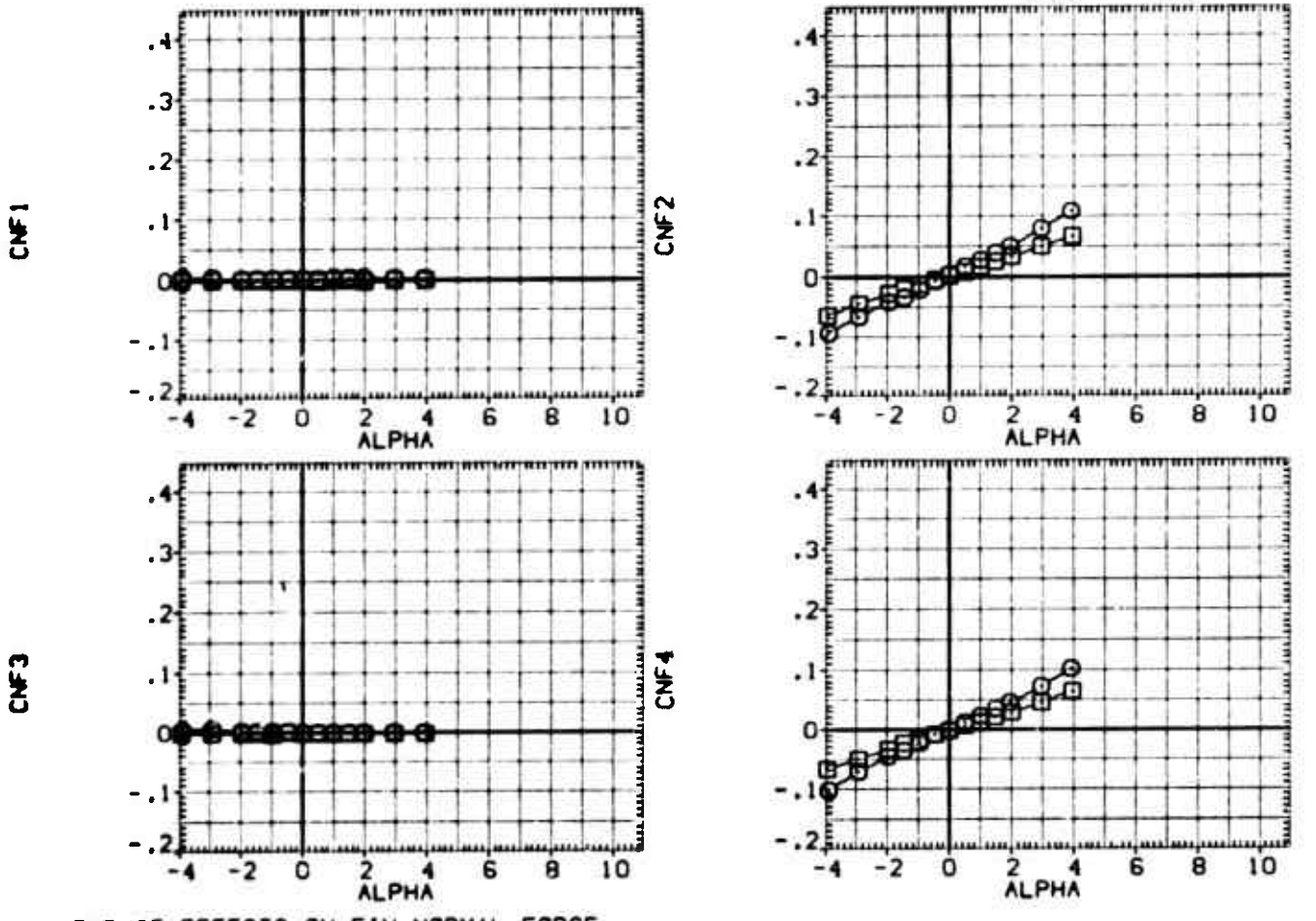
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC TF360 BODY FIN, BF2 (RXE120)

SYMBOL					
□	CRT .010	BETA .000	PHI .000		
□	5.990	FINPOS 3.000	MACH 1.000		

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON FIN NORMAL FORCE

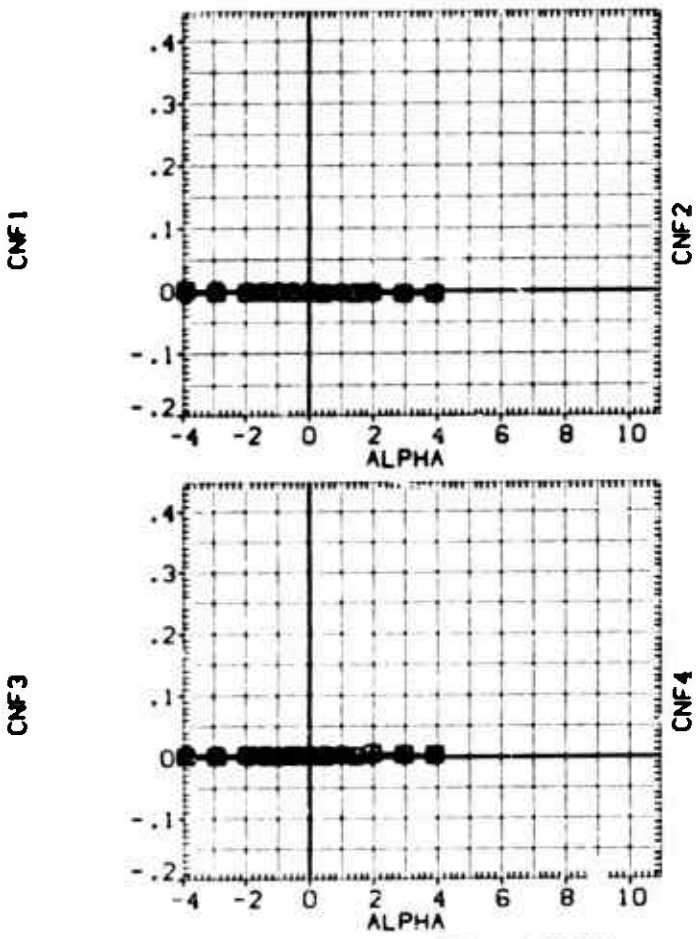
AEDC TF360 BODY FIN, BF2

(CXE121)

SYMBOL	CRT		PARAMETRIC VALUES		
□	.010	BETA	.000	PHI	.000
○	.894	FINPOS	3.000	MACH	1.250
◇	2.016				
△	3.015				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



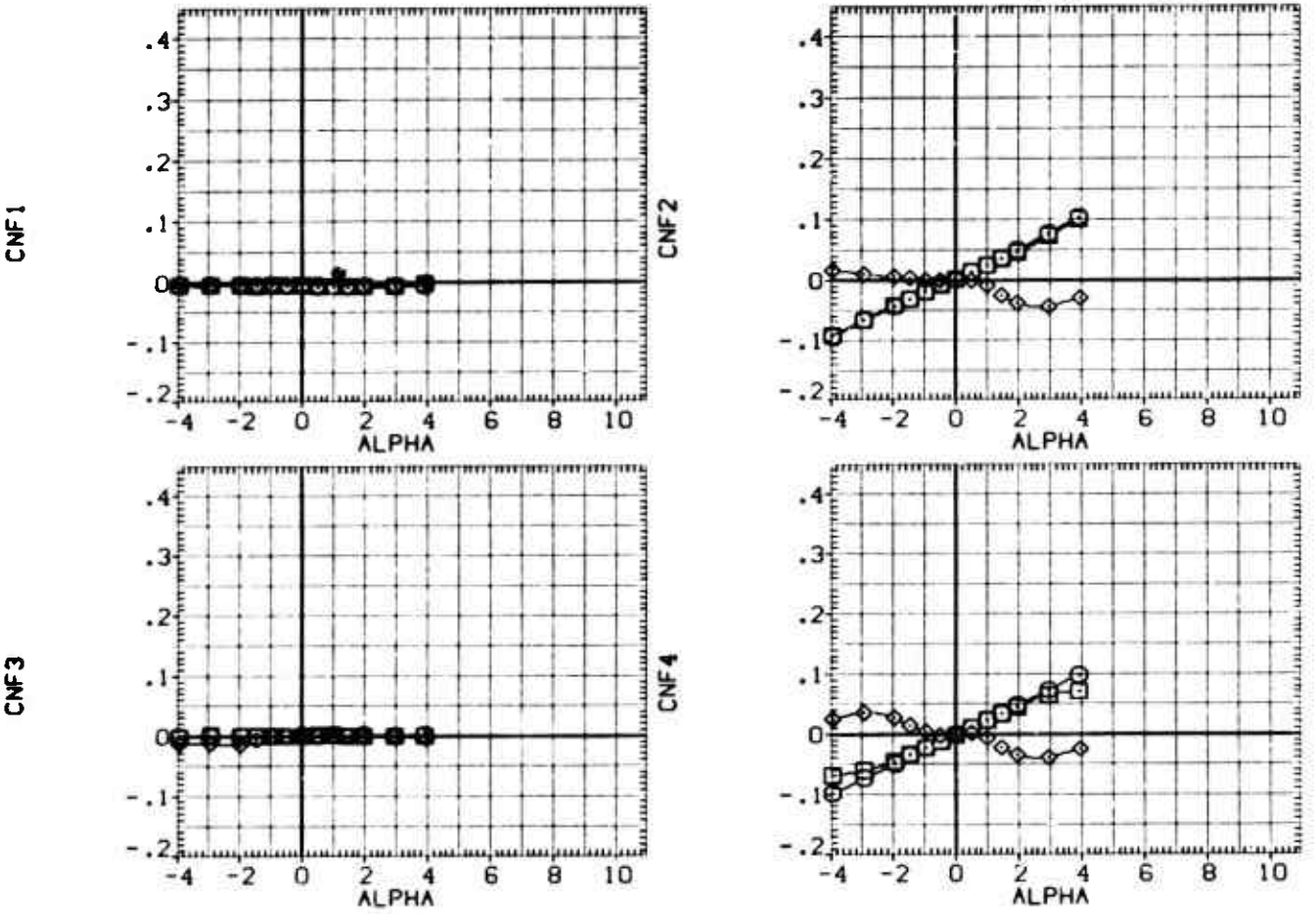
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC TF360 BODY FIN. BF2 (CXE121)

SYMBOL	CRT		PARAMETRIC VALUES		
○	4.006	BETA	.000	PHI	.000
□	6.010	FINPOS	3.000	MACH	1.250
◇	11.905				

REFERENCE INFORMATION

SREF	19.6350	SQ. IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON FIN NORMAL FORCE

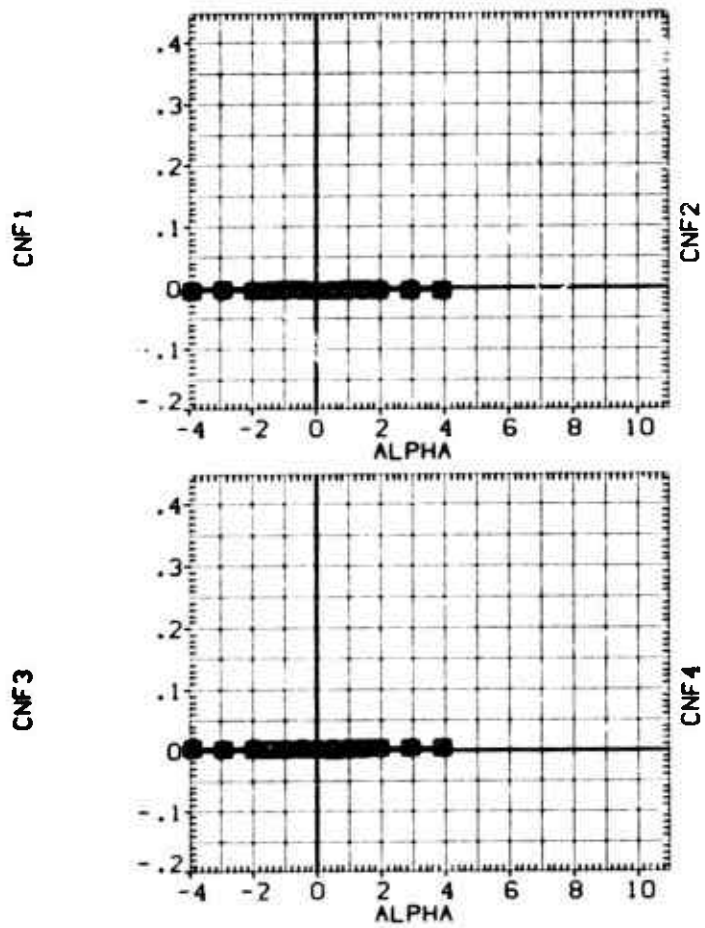
AEDC TF360 BODY FIN, BF2

(RXE122)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.010	BETA	.000	PHI	.000
□	.989	FINPOS	3.000	MACH	1.500
◇	2.008				
△	3.060				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



THRUST EFFECTS ON FIN NORMAL FORCE

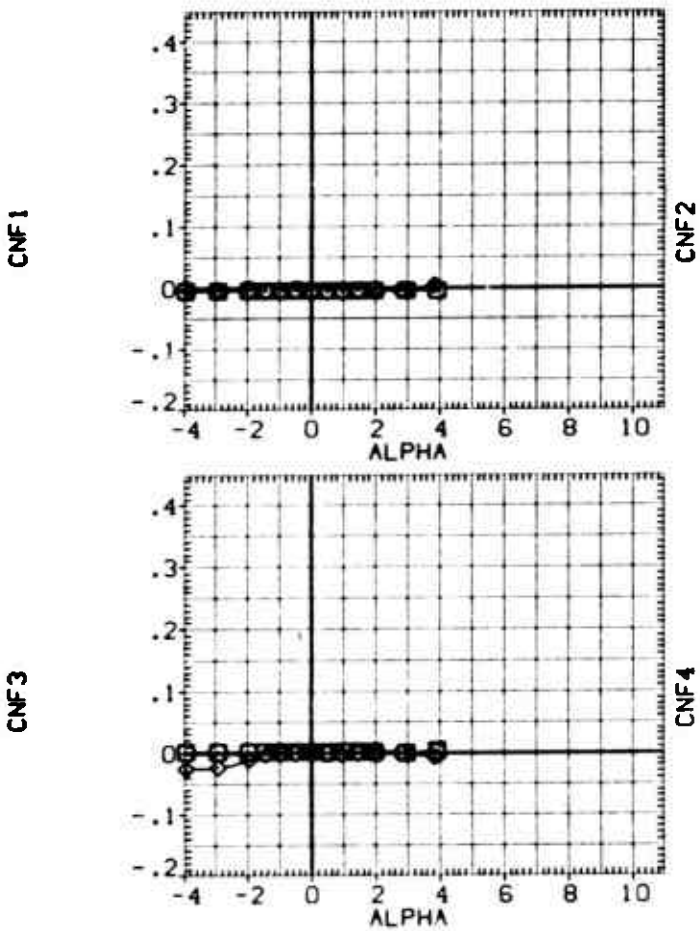
AEOC TF360 BODY FIN, BF2

(RXE122)

SYMBOL	CRT		PARAMETRIC VALUES		
○	4.008	BETA	.000	PHI	.000
□	5.988	FINPOS	3.000	MACH	1.500
◇	11.951				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



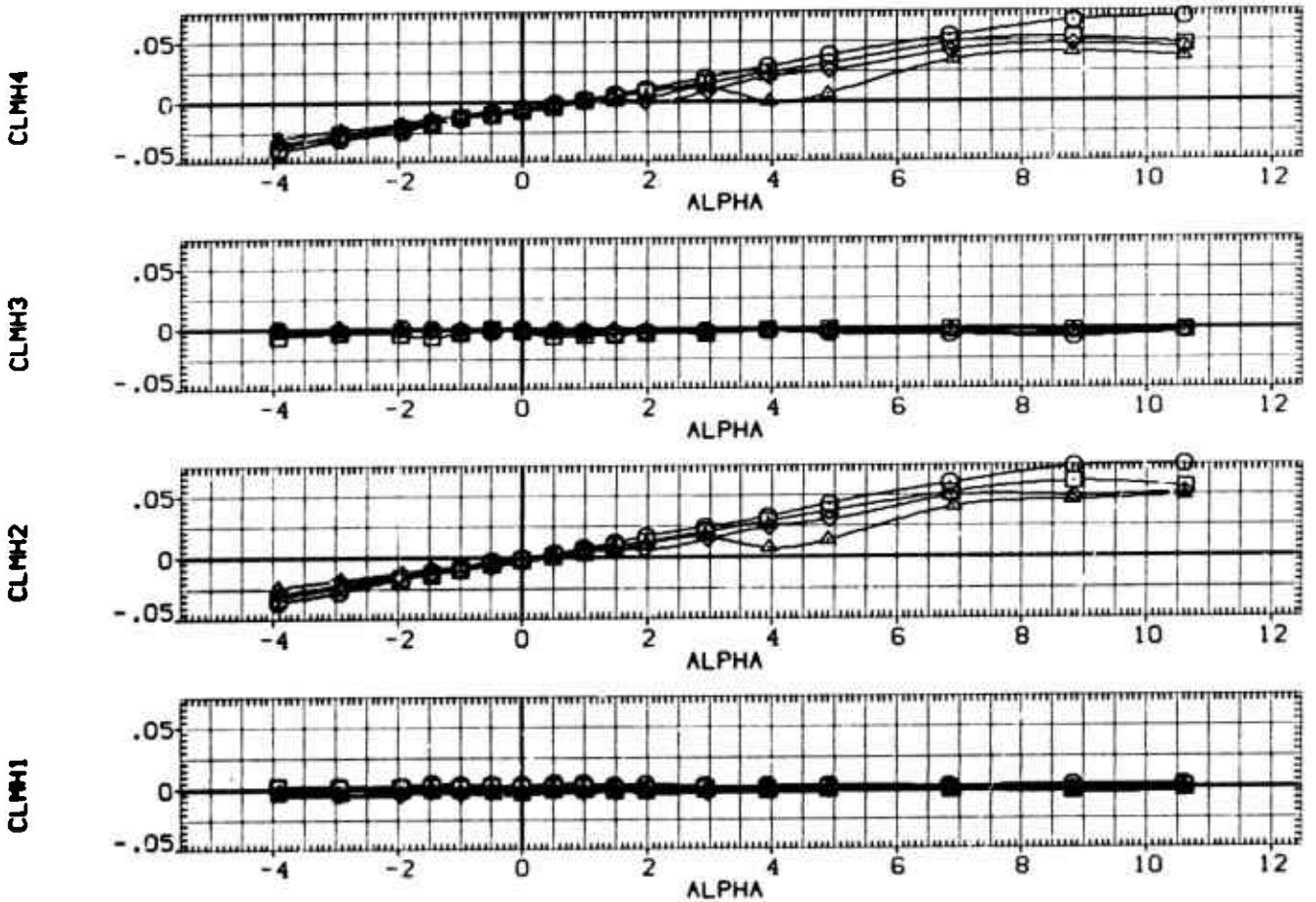
THRUST EFFECTS ON FIN NORMAL FORCE

AEDC TF360 BODY FIN, BF1 (RXE209)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.575	BETA	.000	PHI	.000
□	26.074	FINPOS	3.000	MACH	.200
◇	50.139				
△	100.918				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	

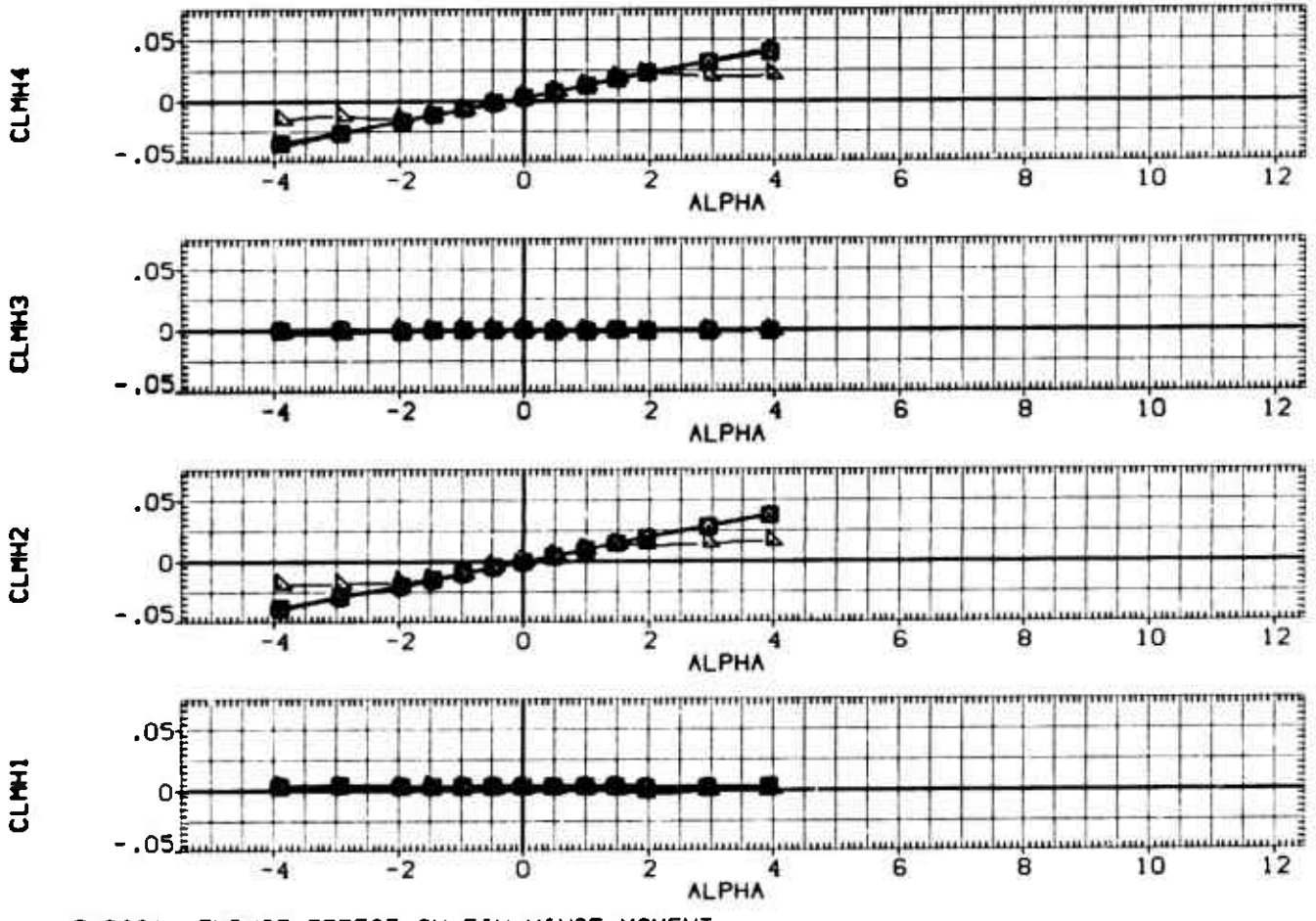


TYPICAL THRUST EFFECT ON FIN HINGE MOMENT

AEDC TF360 BODY FIN. BF1 (RXE213)

SYMBOL	CRT	PARAMETRIC VALUES			
○	.010	BETA	.000	PHI	.000
△	3.042	FINPOS	3.000	MACH	1.250
◇	4.014				
□	6.006				
▷	11.926				

REFERENCE INFORMATION		
SREF	19.6350	SQ. IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



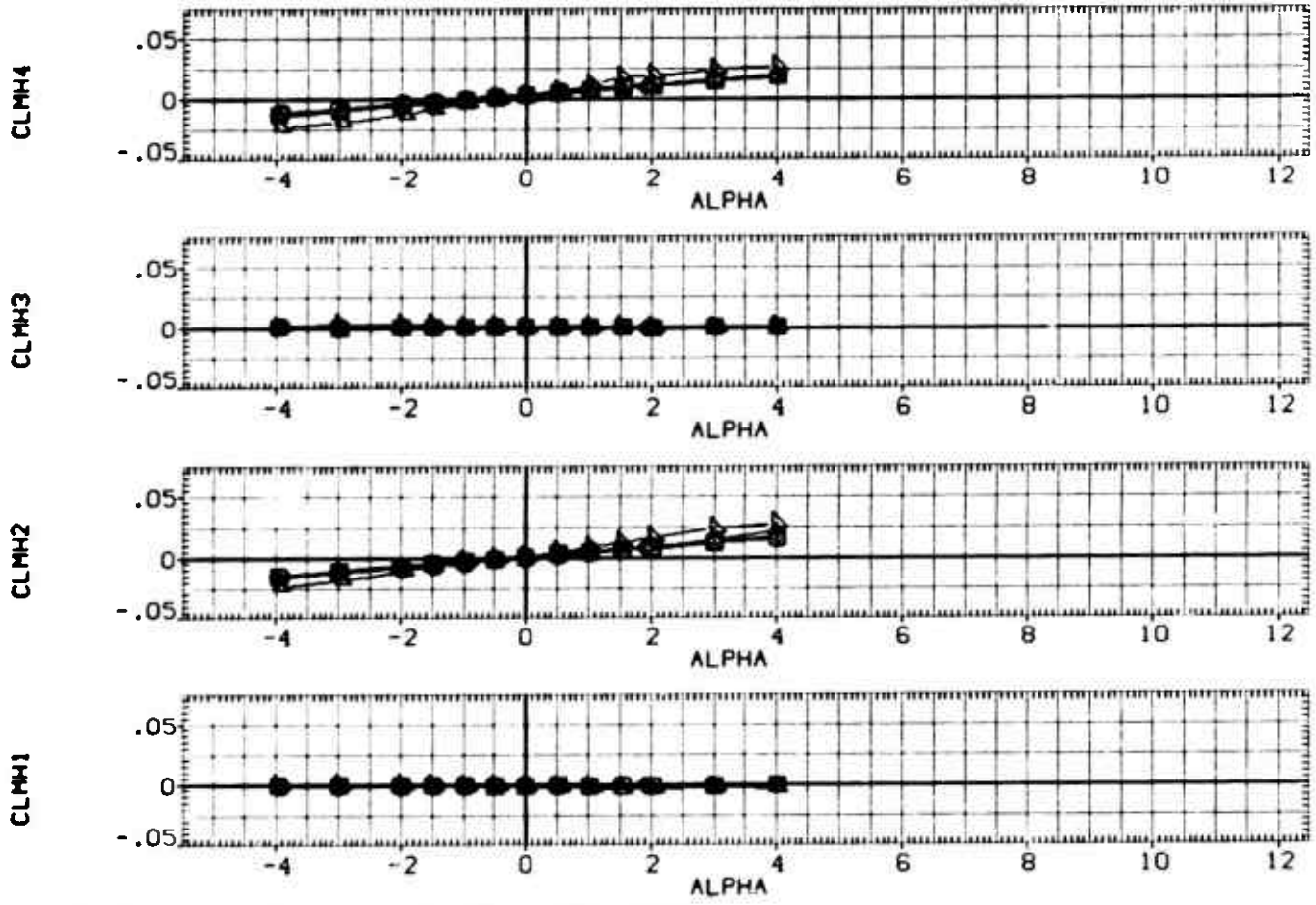
TYPICAL THRUST EFFECT ON FIN HINGE MOMENT

AEDC SF172 BODY FIN, BF1 (RXE216)

SYMBOL	CRT		PARAMETRIC VALUES		
○	-.000	BETA	.000	PHI	.000
□	2.011	FINPOS	3.000	MACH	2.000
◇	3.989				
△	6.009				
▽	11.932				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



TYPICAL THRUST EFFECT ON FIN HINGE MOMENT

AEDC TF360 BODY FIN. BF1 (RXE209)

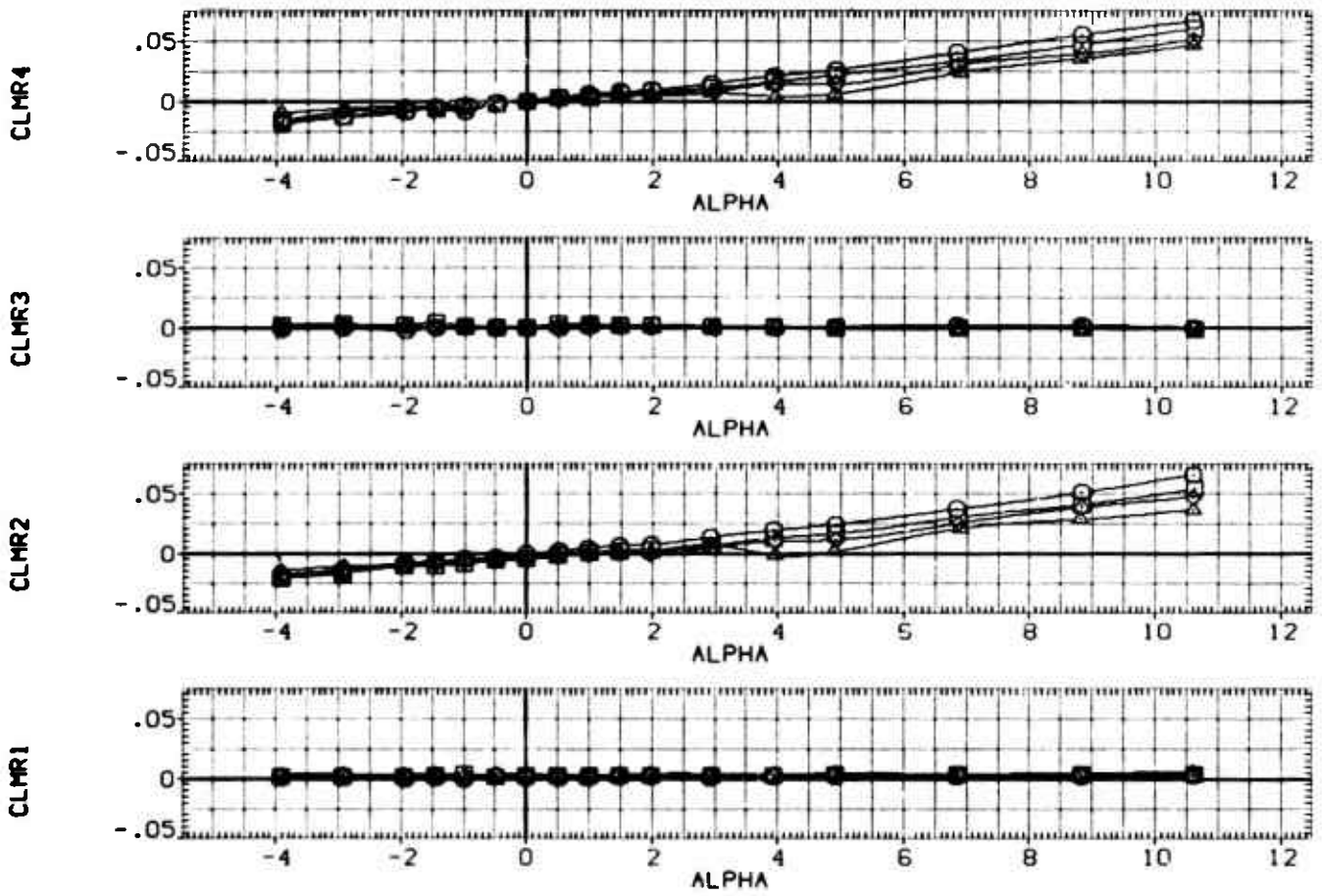
SYMBOL	CRT
○	.575
□	26.074
◇	50.139
△	100.918

PARAMETRIC VALUES

BETA	.000	PHI	.000
FINPOS	3.000	MACH	.200

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



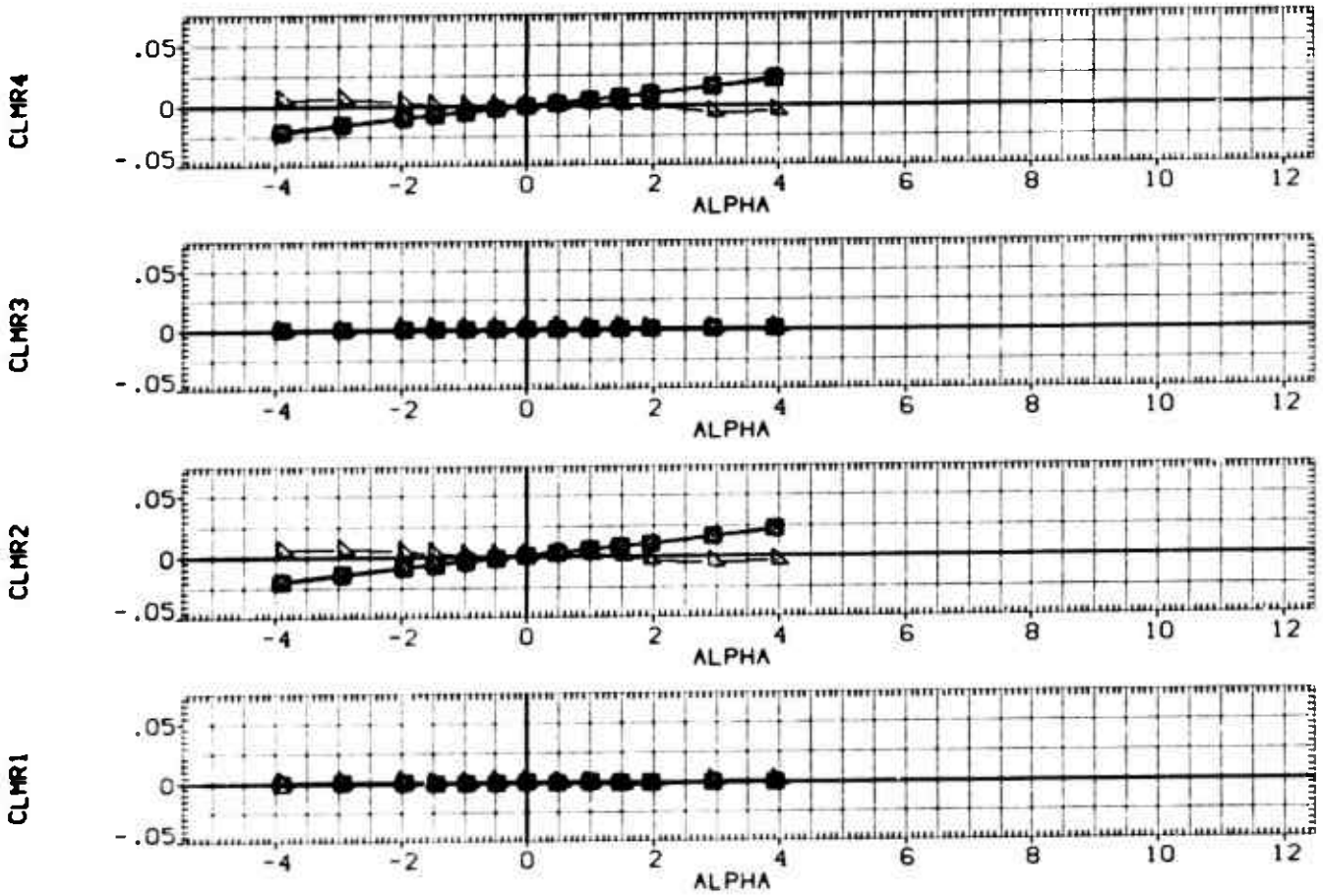
TYPICAL THRUST EFFECT ON FIN ROOT BENDING MOMENT

AEDC TF360 BODY FIN. BF1 (RXE213)

SYMBOL	CRT		PARAMETRIC VALUES		
○	.010	BETA	.000	PHI	.000
□	3.042	FINPOS	3.000	MACH	1.250
◇	4.014				
▷	6.006				
△	11.926				

REFERENCE INFORMATION

SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



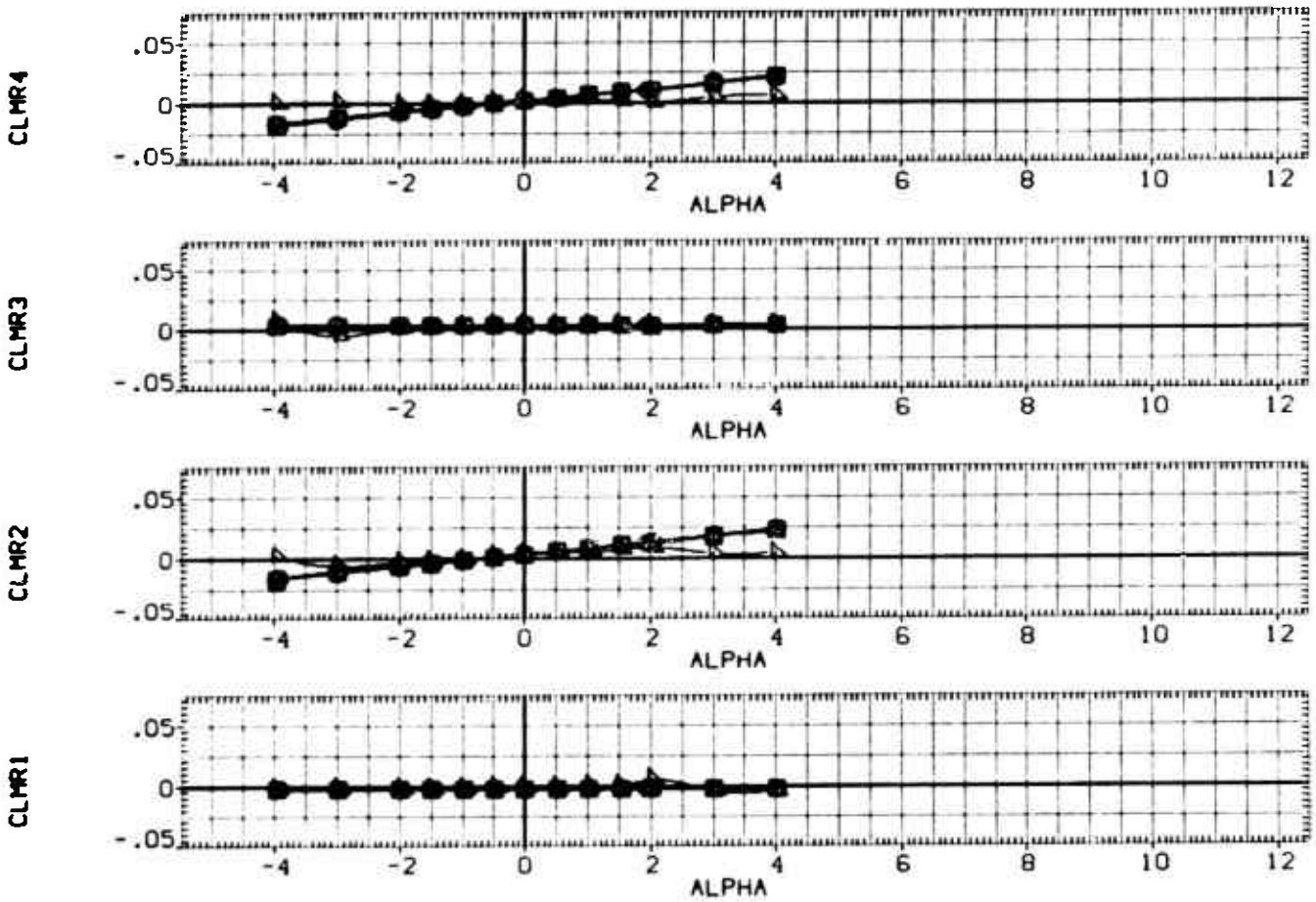
TYPICAL THRUST EFFECT ON FIN ROOT BENDING MOMENT

AEDC SF172 BODY FIN, BF1 (RXE216)

SYMBOL	CPT		PARAMETRIC VALUES		
○	-.000	BETA	.000	PHI	.000
□	2.011	FINPOS	3.000	MACH	2.000
◇	3.969				
△	6.009				
▷	11.932				

REFERENCE INFORMATION

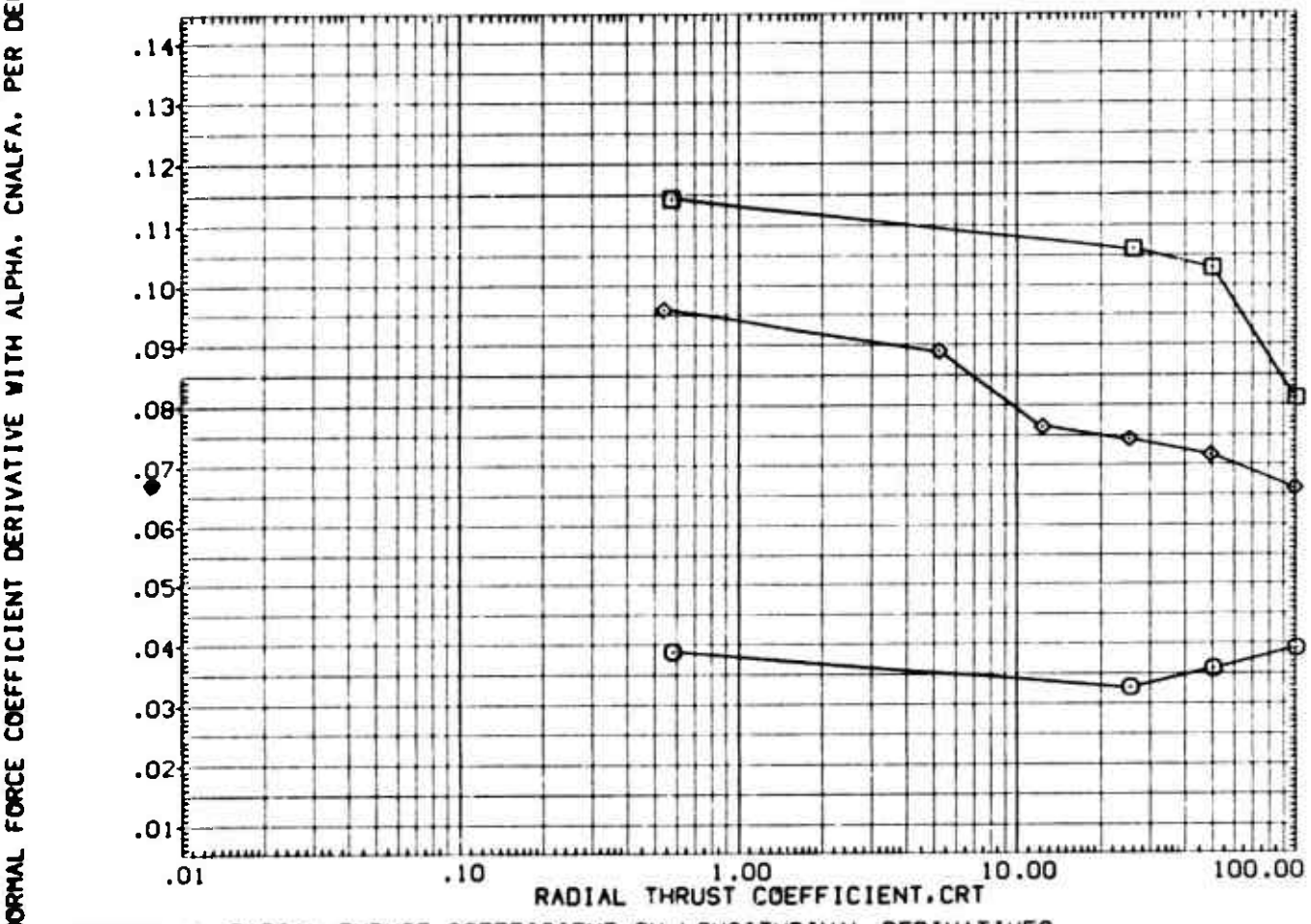
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



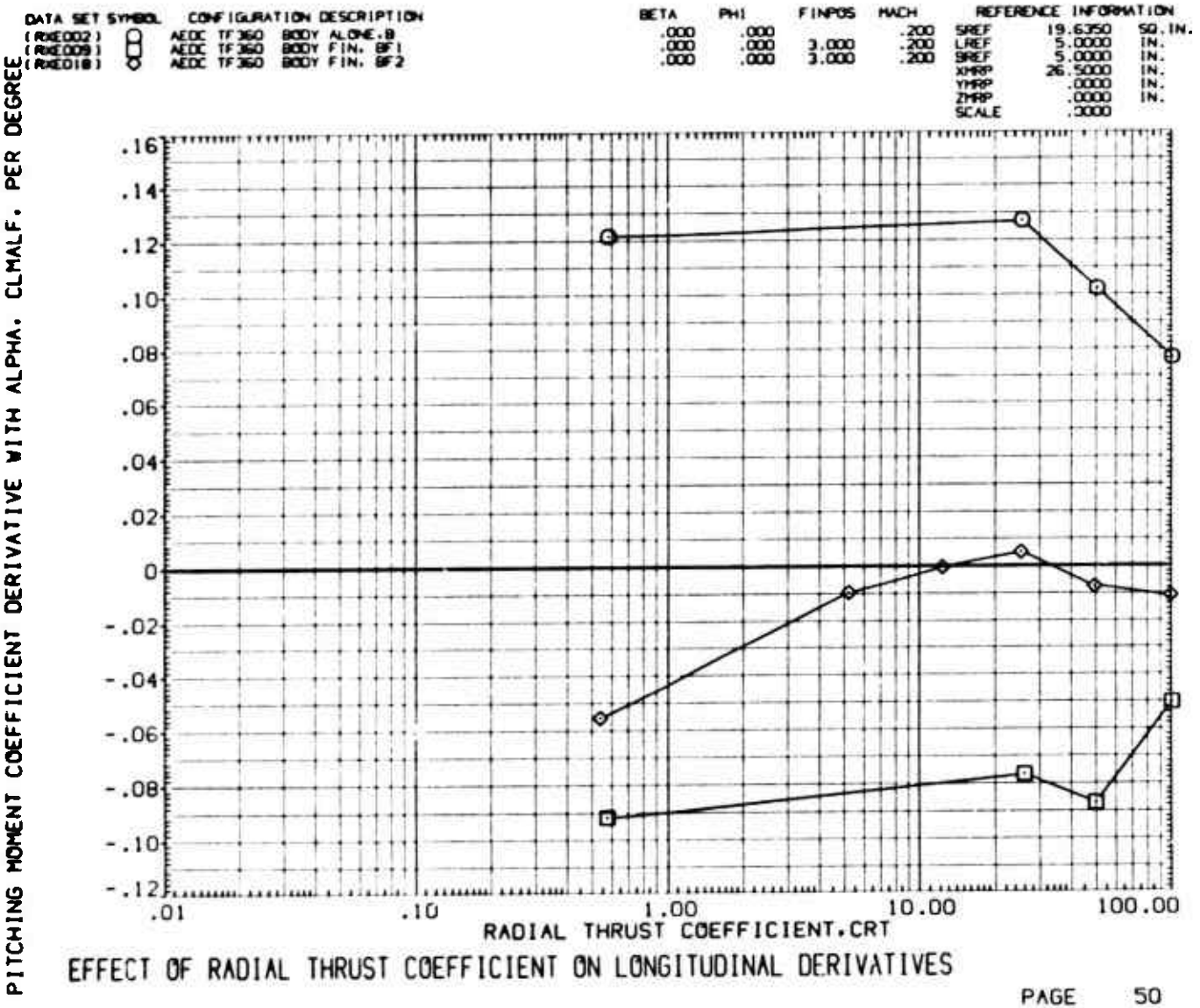
TYPICAL THRUST EFFECT ON FIN ROOT BENDING MOMENT

DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	FINPOS	MACH
(RXE002)	□	AEDC TF360 BODY ALONE,B	.000	.000		.200
(RXE009)	○	AEDC TF360 BODY FIN, BF1	.000	.000	3.000	.200
(RXE018)	◇	AEDC TF360 BODY FIN, BF2	.000	.000	3.000	.200

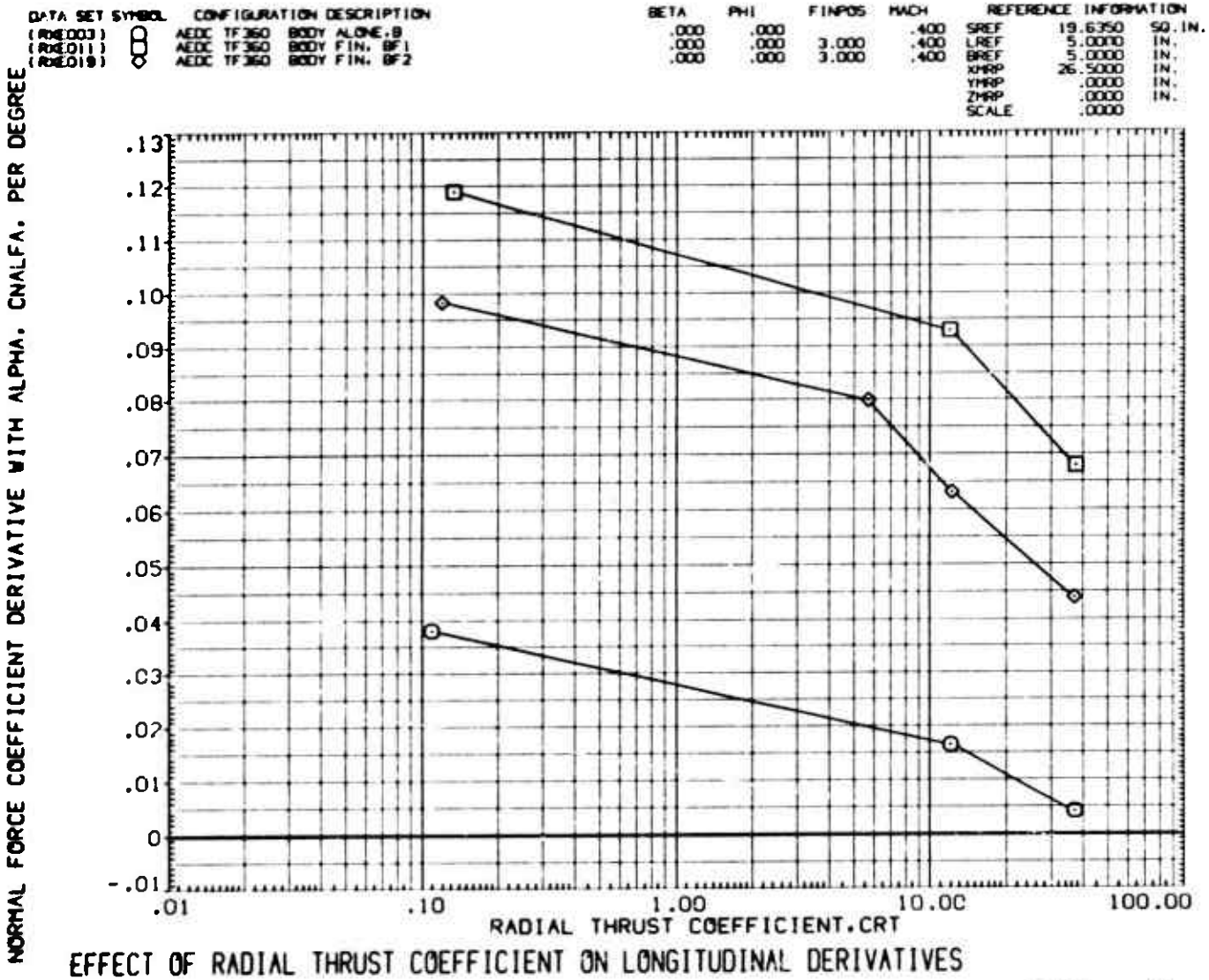
REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



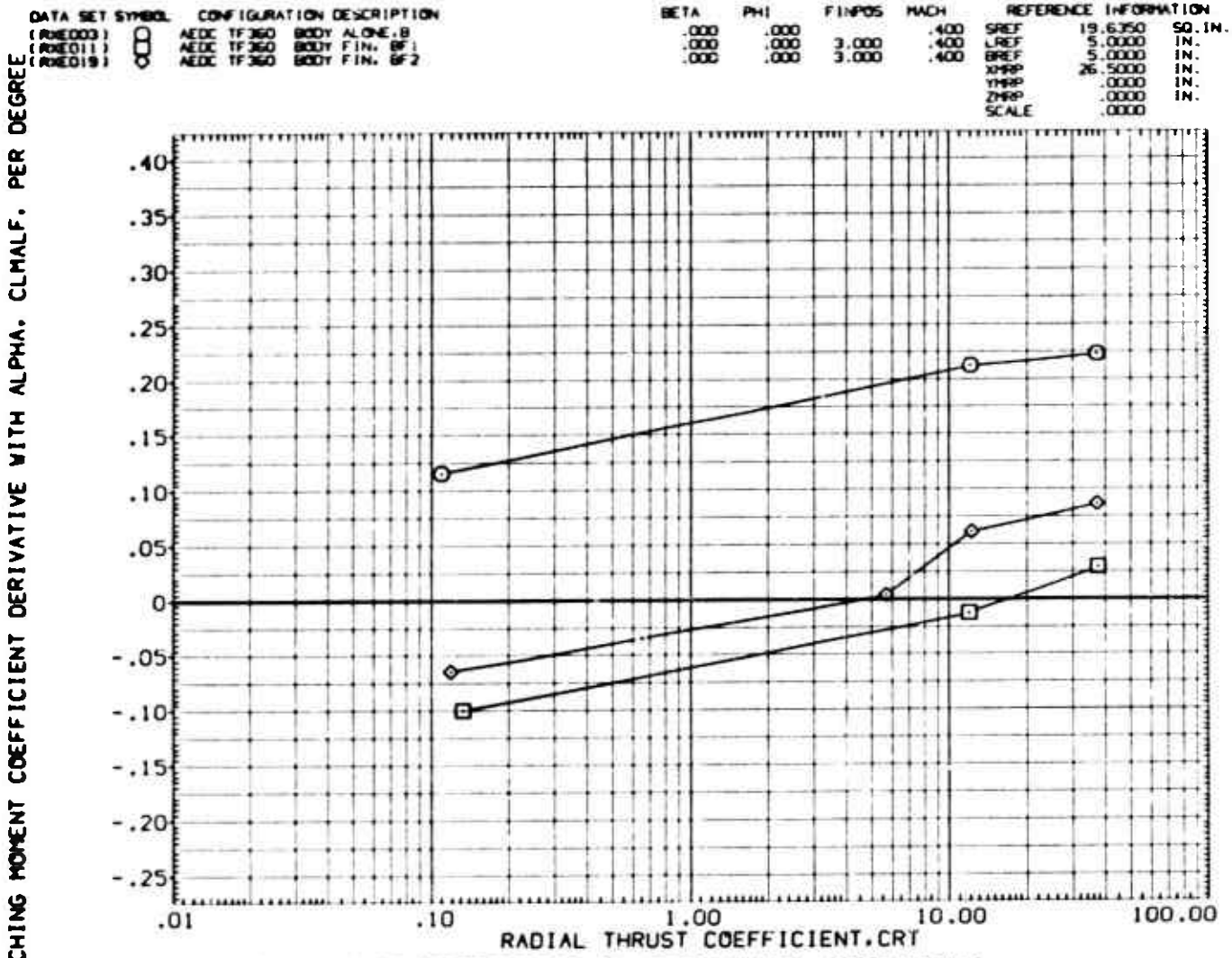
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



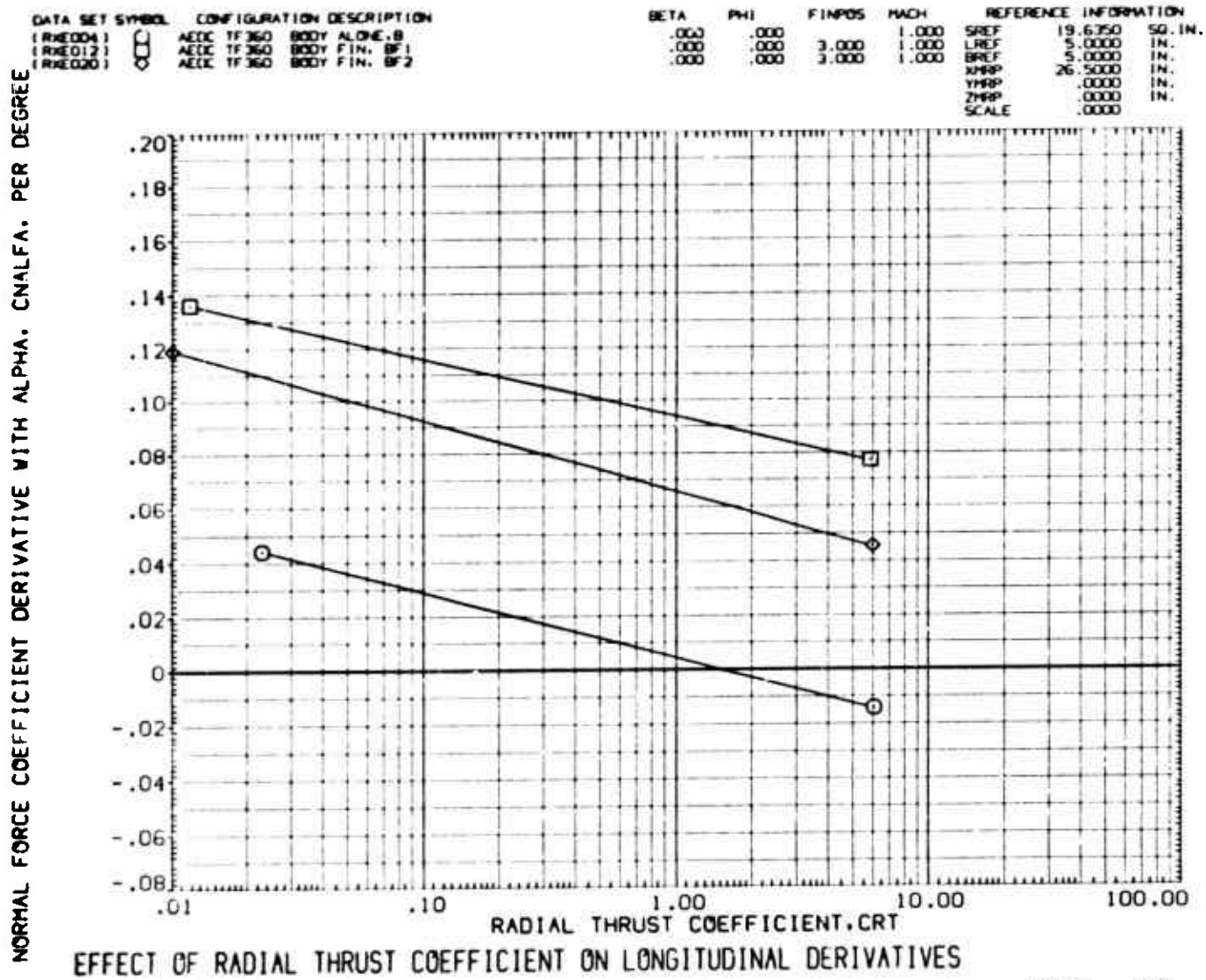
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



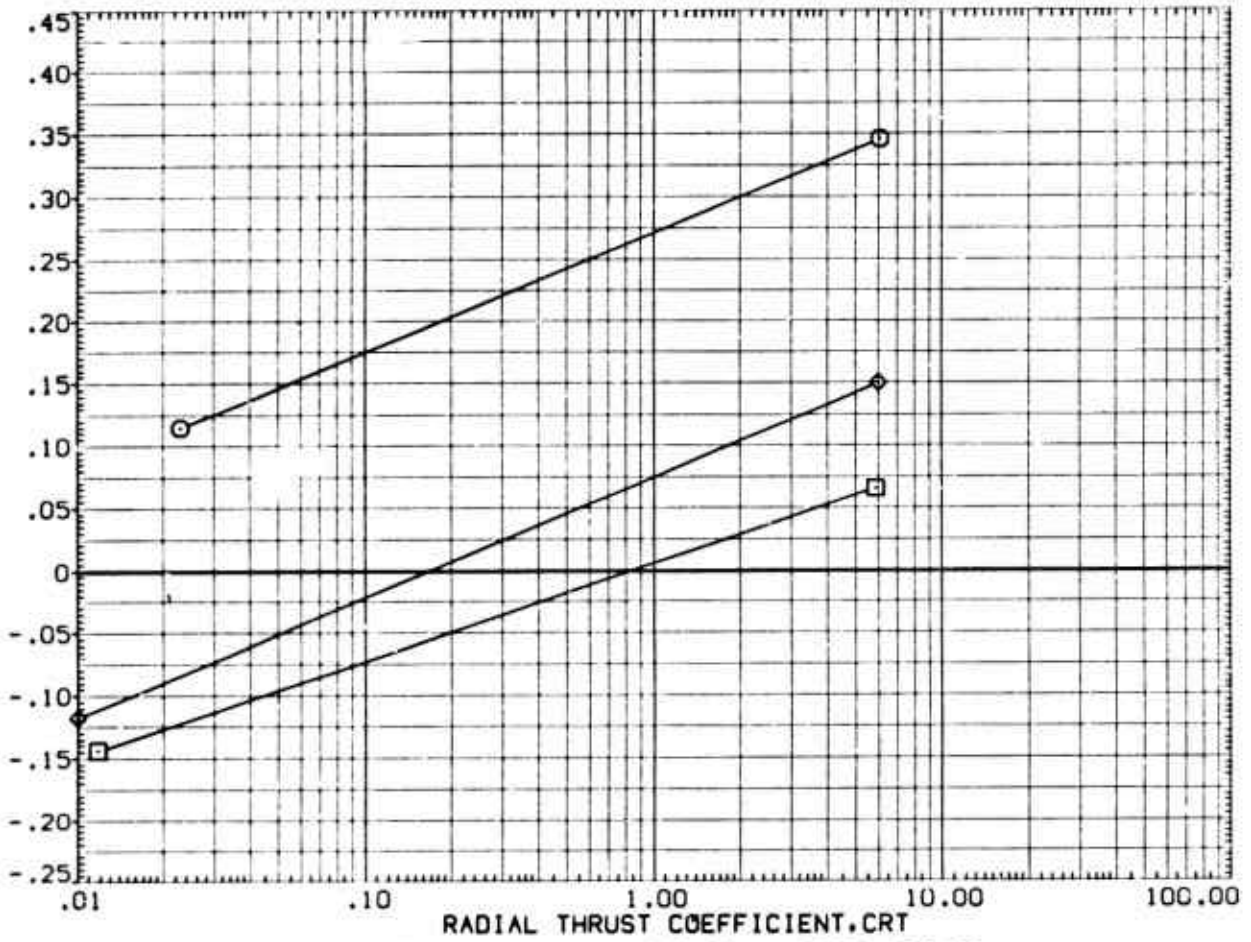
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



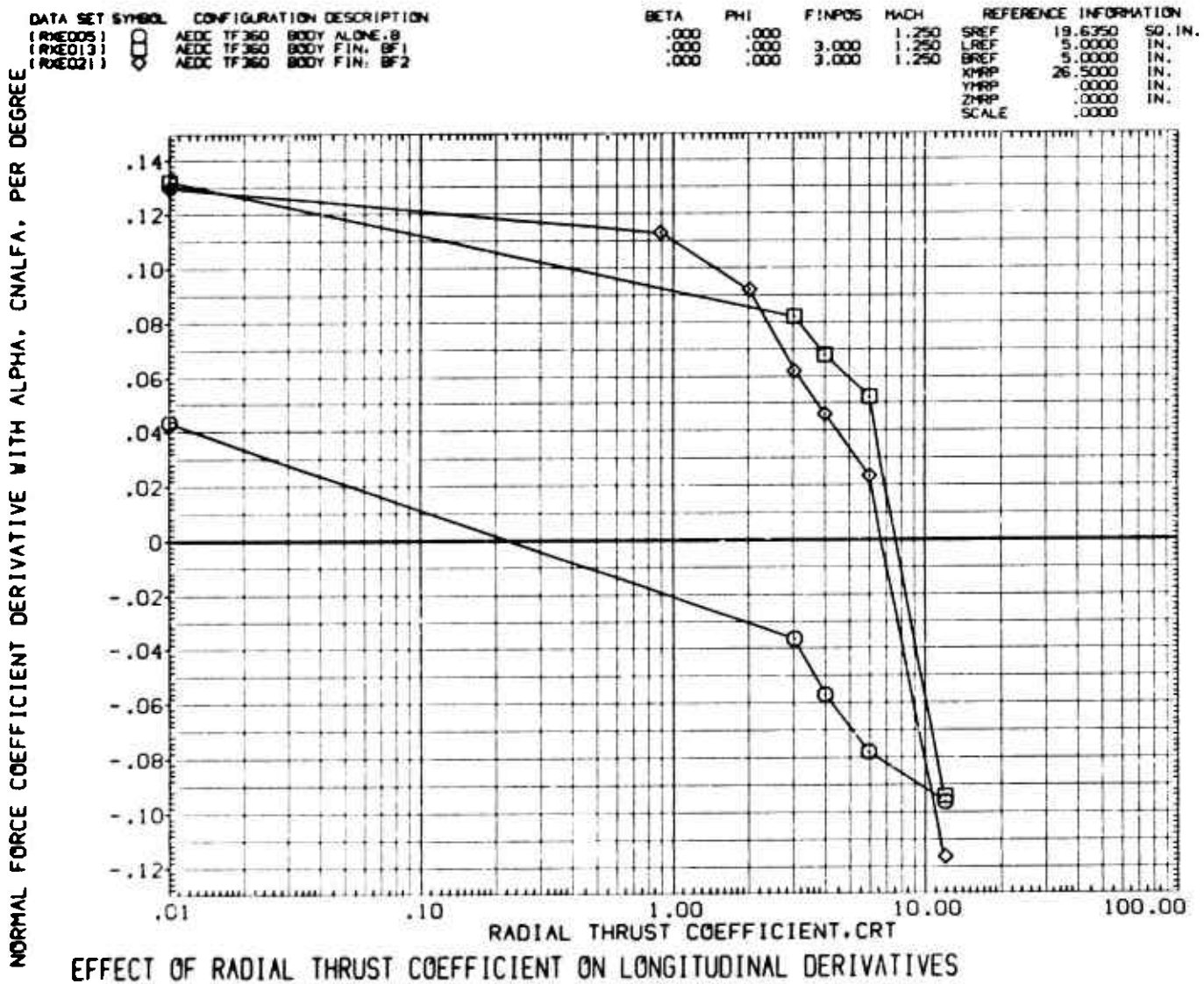
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	FINPOS	MACH
(RXE304)	○	AEDC TF360 BODY ALONE,B	.000	.000		1.000
(RXE012)	□	AEDC TF360 BODY FIN, BF1	.000	.000	3.000	1.000
(RXE028)	◇	AEDC TF360 BODY FIN, BF2	.000	.000	3.000	1.000

REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



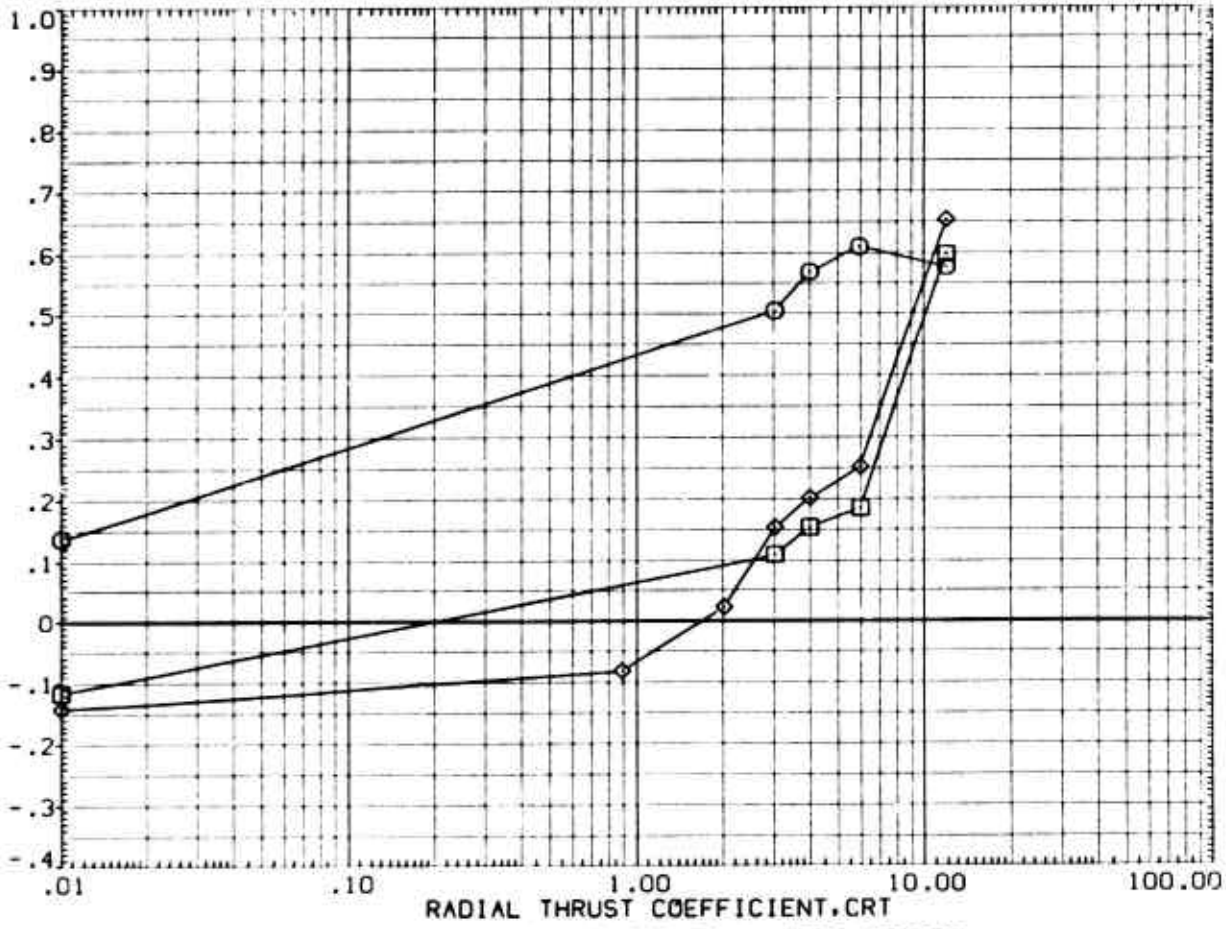
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



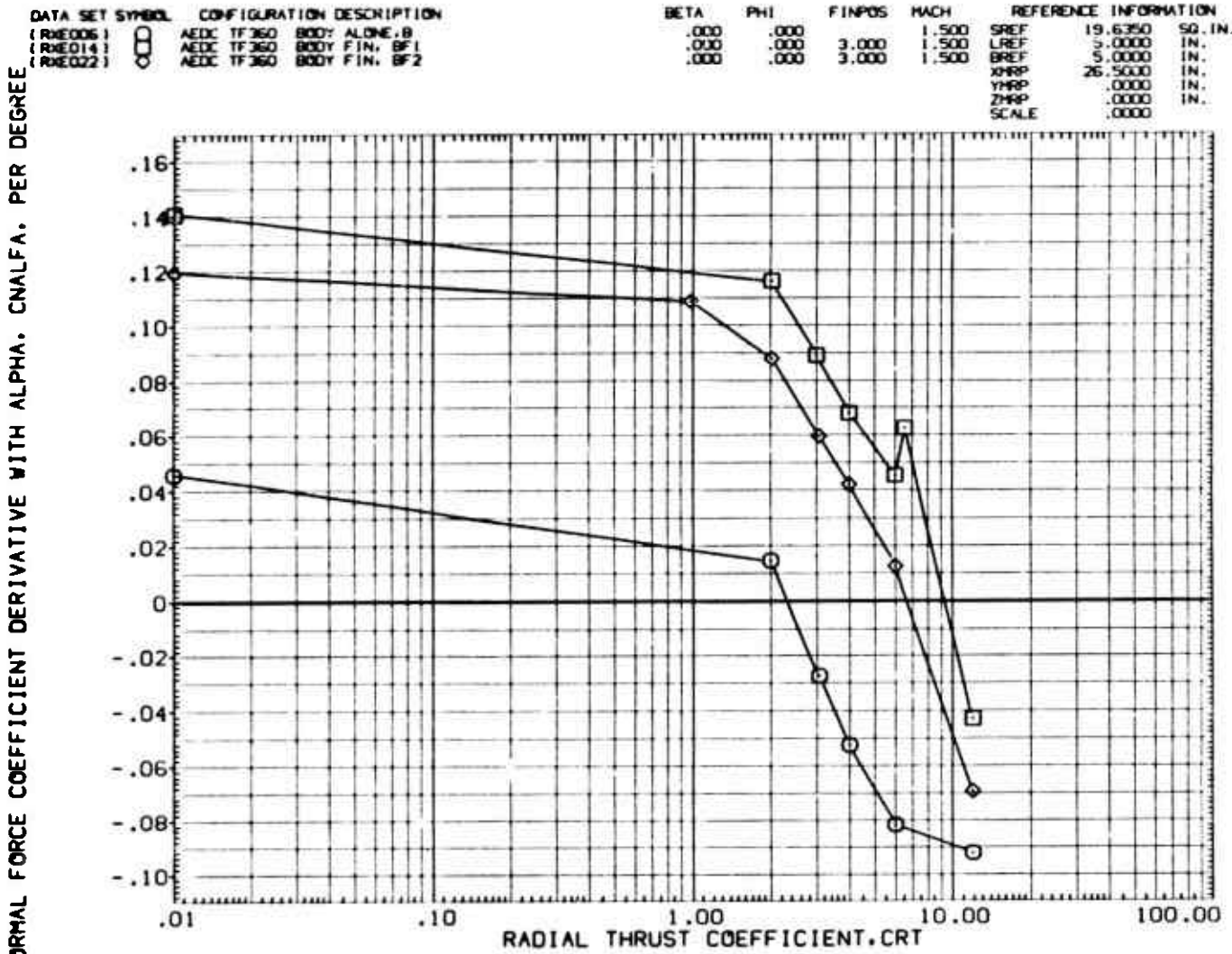
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	FINPOS	MACH
(RXE005)	□	AEDC TF360 BODY ALONE,B	.000	.000		1.250
(RXE013)	○	AEDC TF360 BODY FIN, BF1	.000	.000	3.000	1.250
(RXE021)	◇	AEDC TF360 BODY FIN, BF2	.000	.000	3.000	1.250

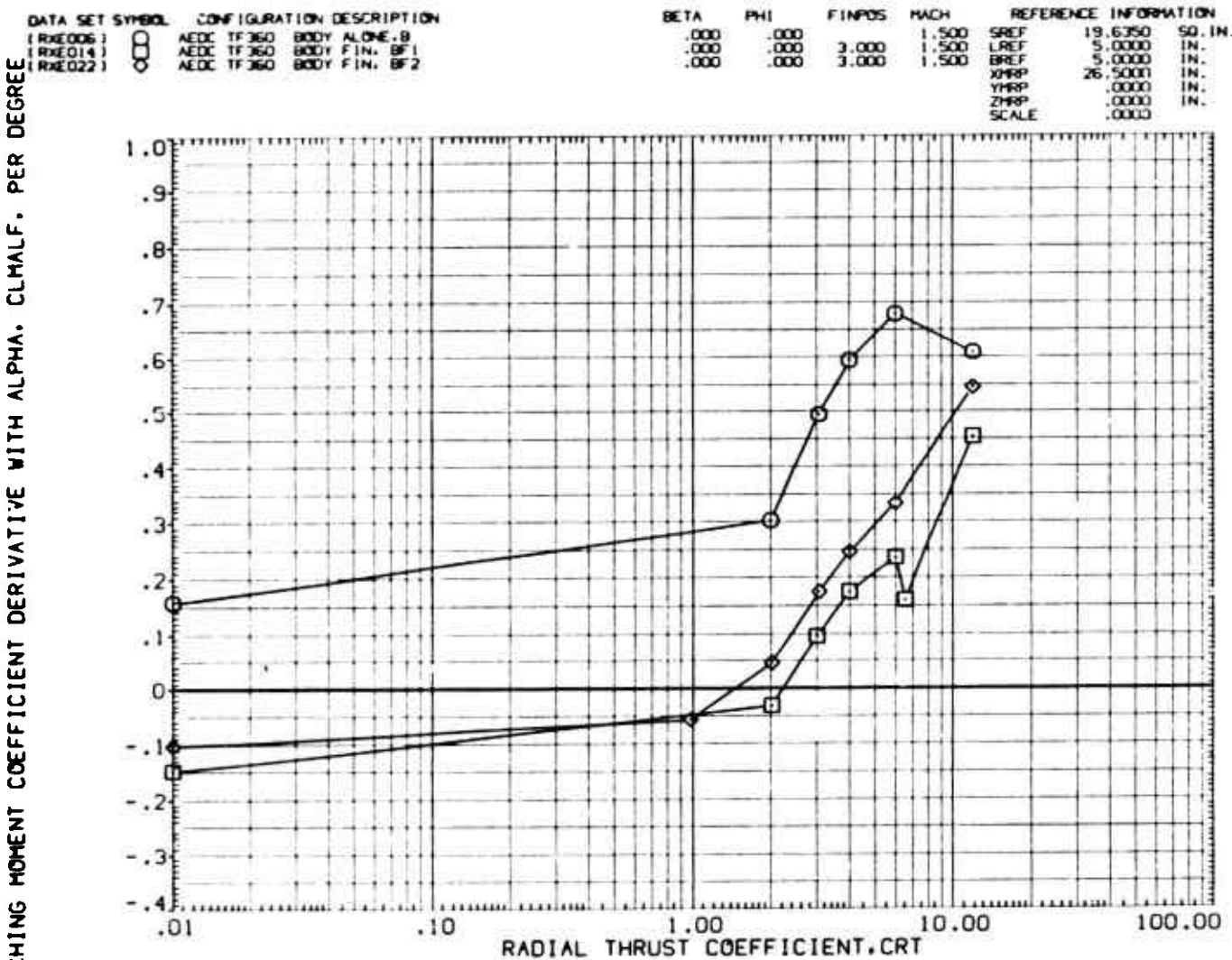
REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



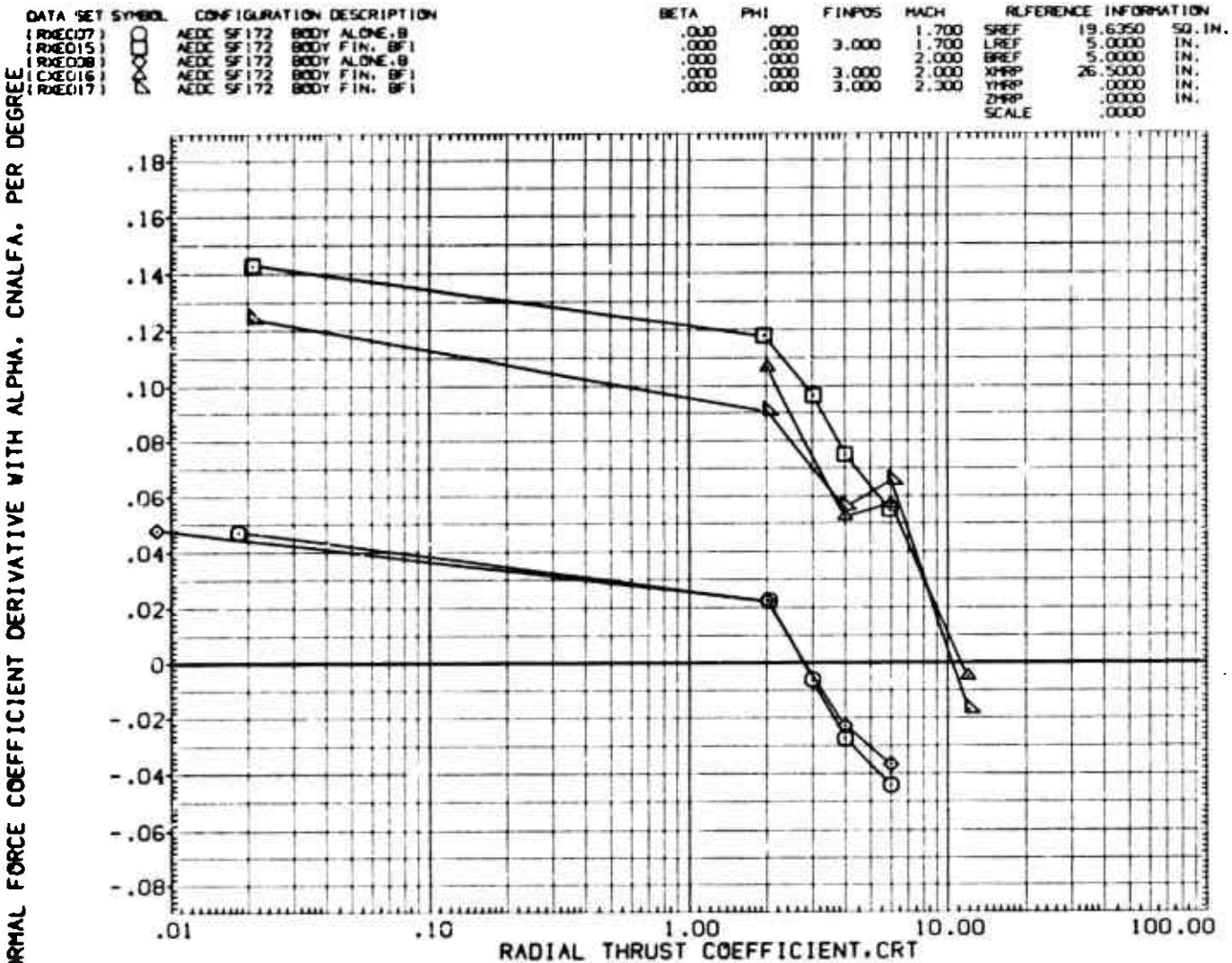
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



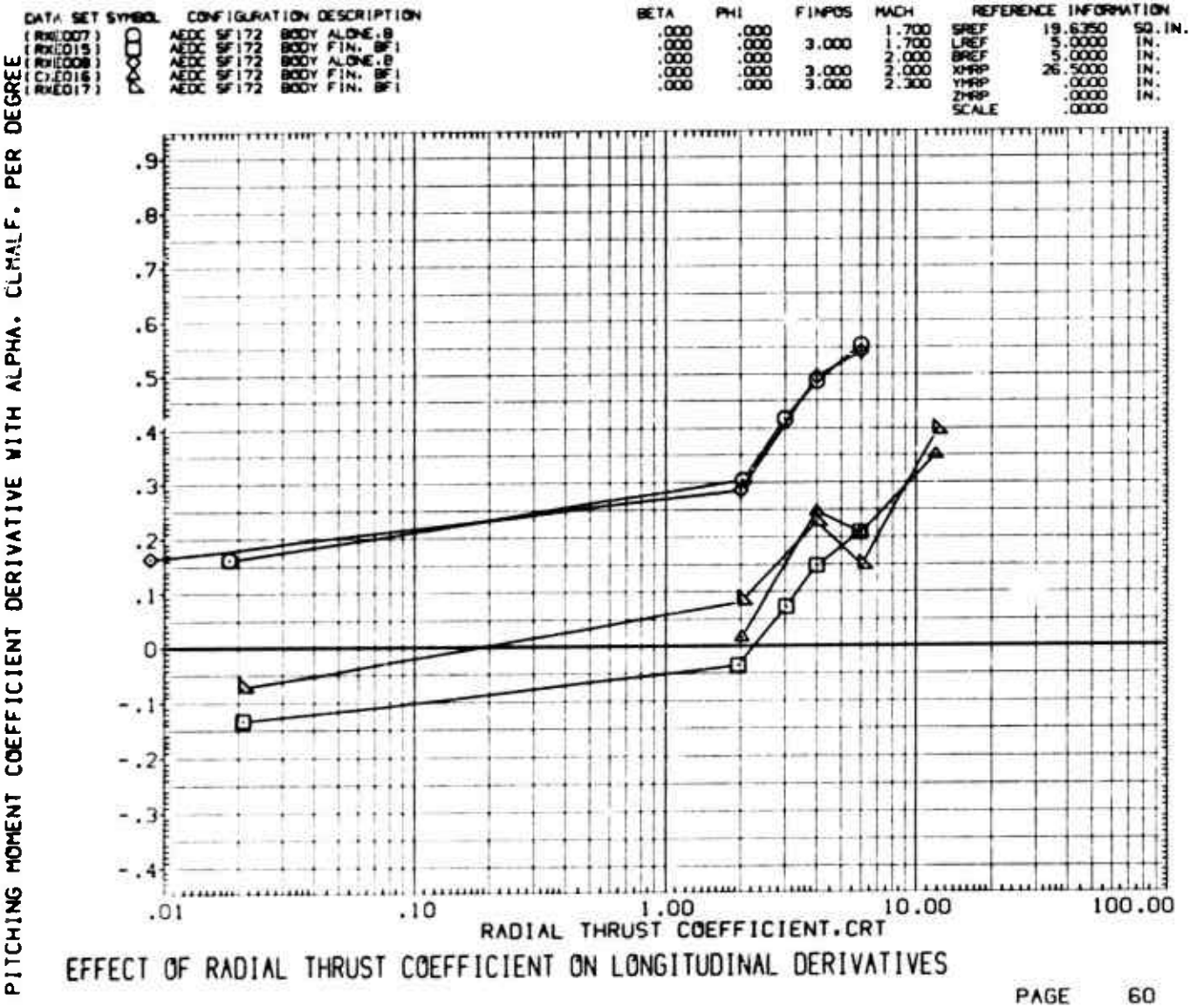
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



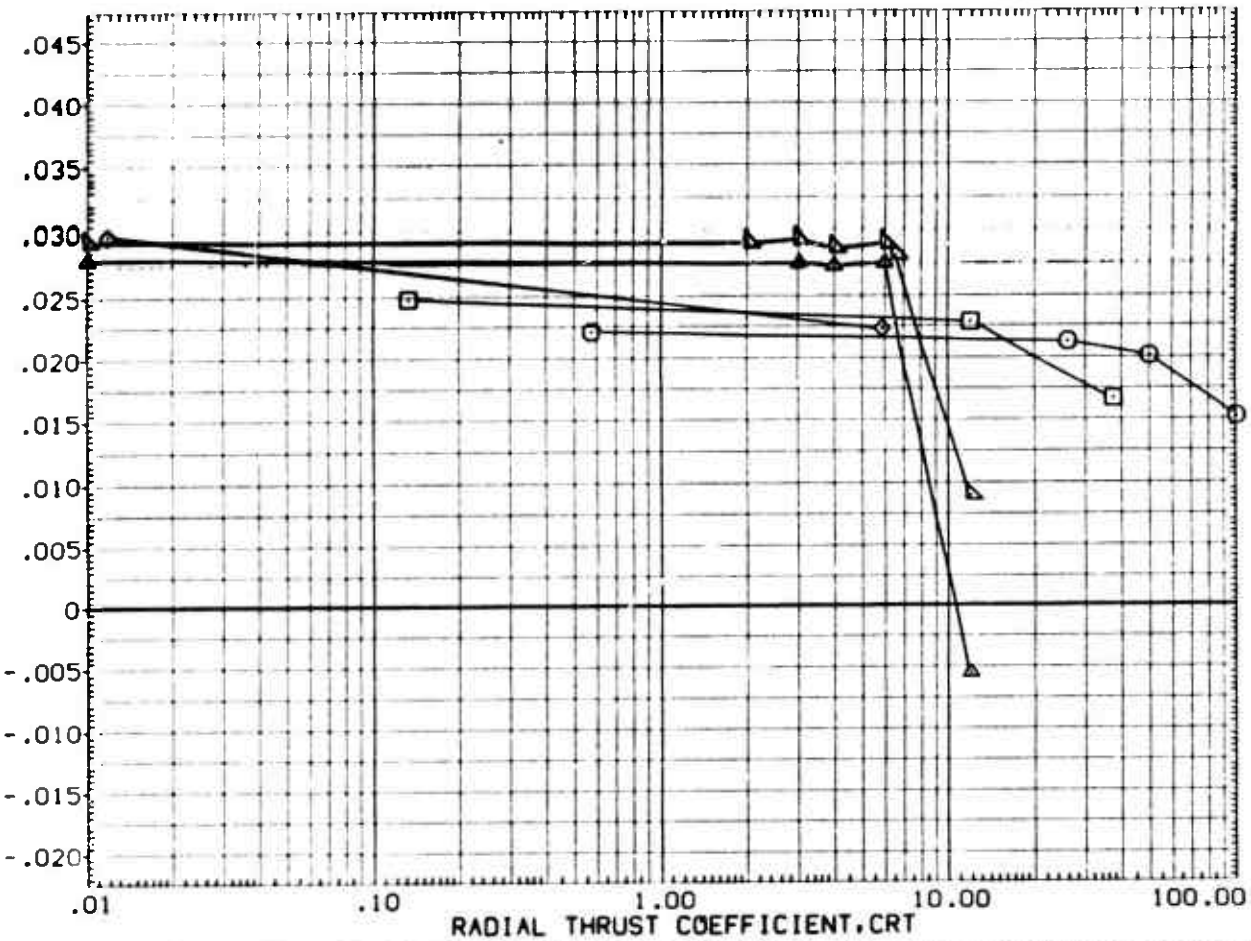
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES



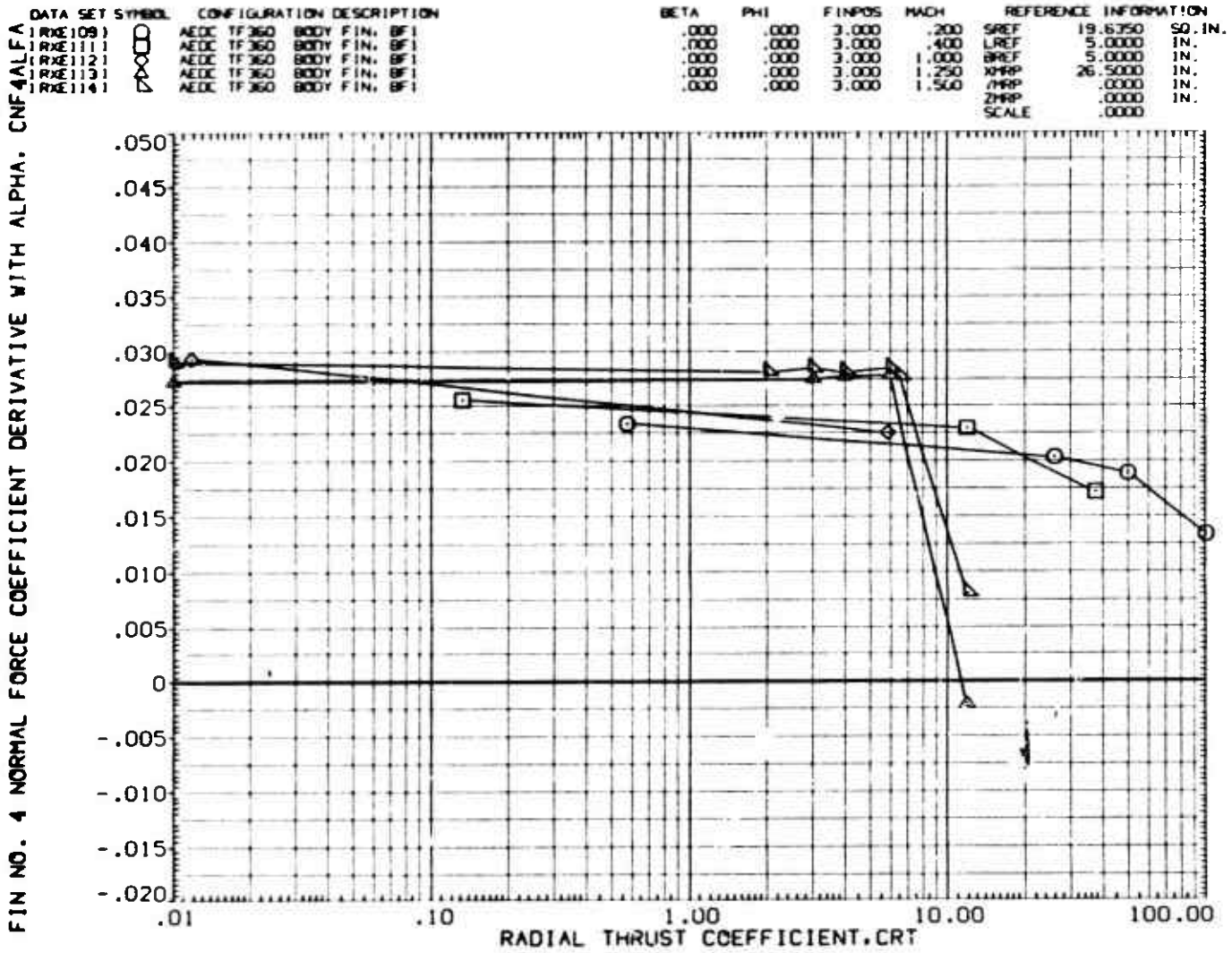
EFFECT OF RADIAL THRUST COEFFICIENT ON LONGITUDINAL DERIVATIVES

DATA SET	SYMBOL	CONFIGURATION DESCRIPTION	BETA	PHI	FINPOS	MACH
(RUN 109)		AEDC TF360 BODY FIN. BF)	.000	.000	3.000	.200
(RUN 111)		AEDC TF360 BODY FIN. BF)	.000	.000	3.000	.400
(RUN 112)		AEDC TF360 BODY FIN. BF)	.000	.000	3.000	1.000
(RUN 113)		AEDC TF360 BODY FIN. BF)	.000	.000	3.000	1.250
(RUN 114)		AEDC TF360 BODY FIN. BF)	.000	.000	3.000	1.500

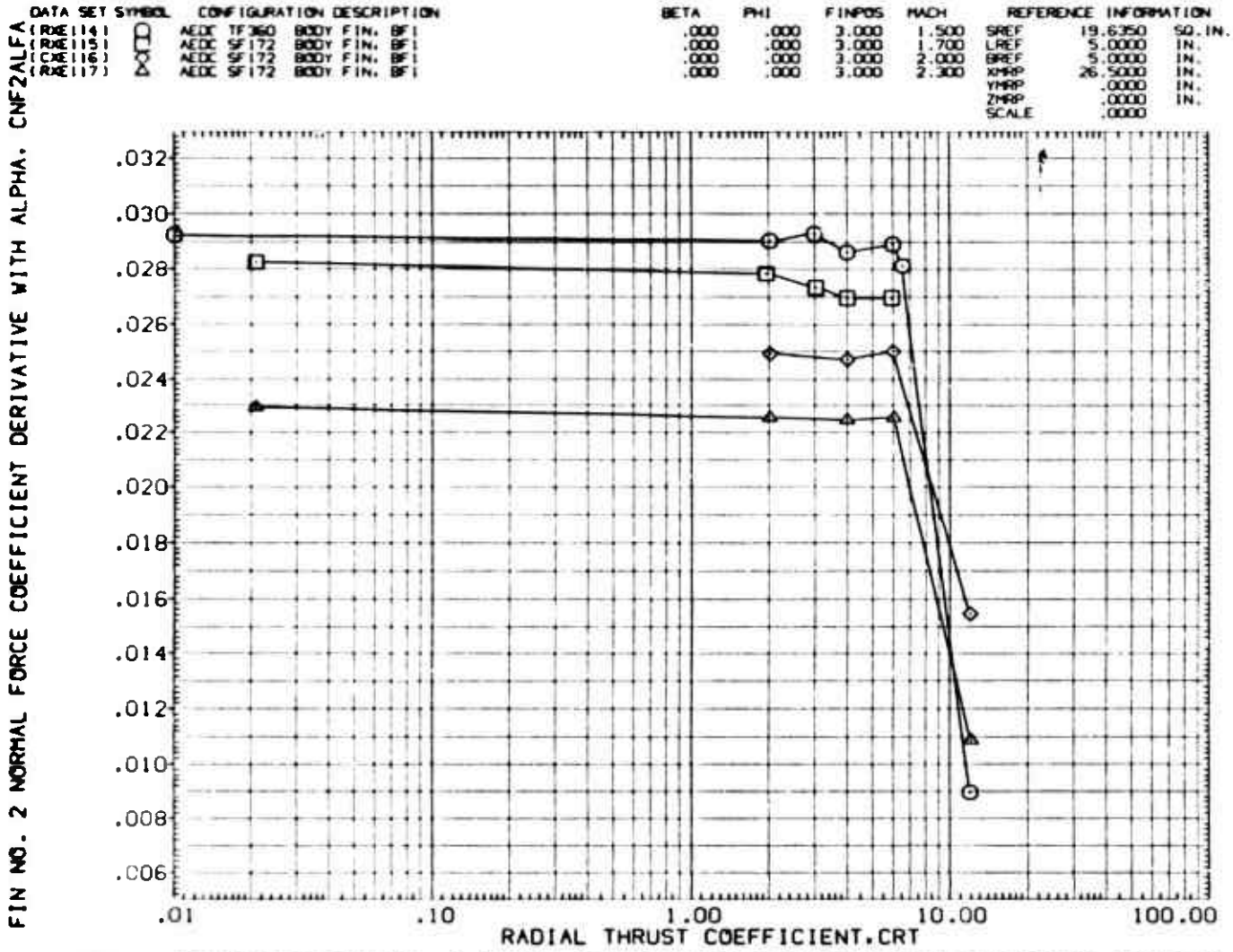
REFERENCE INFORMATION		
SREF	19.6350	SQ.IN.
LREF	5.0000	IN.
BREF	5.0000	IN.
XMRP	26.5000	IN.
YMRP	.0000	IN.
ZMRP	.0000	IN.
SCALE	.0000	



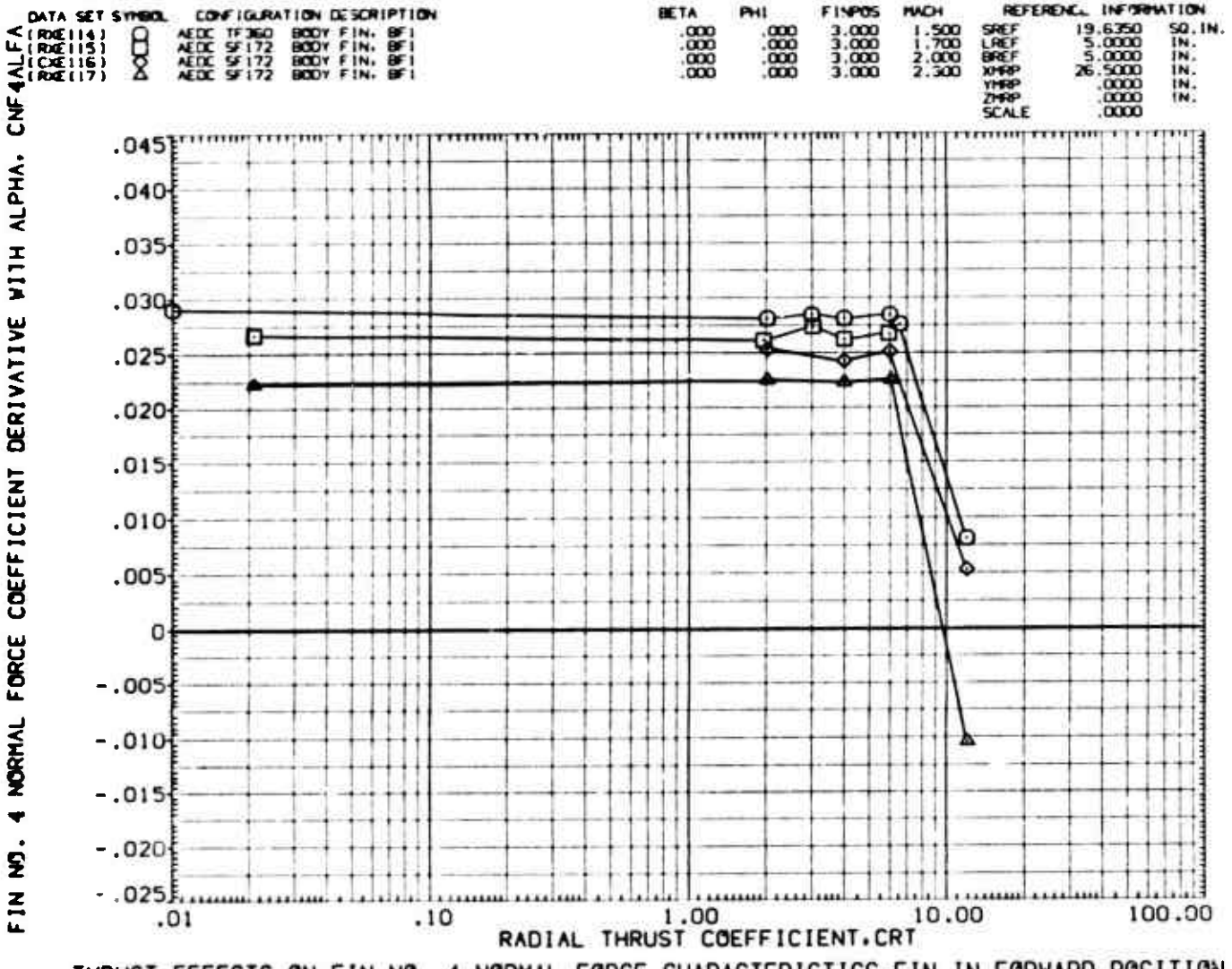
THRUST EFFECTS ON FIN NO. 2 NORMAL FORCE CHARACTERISTICS-FIN IN FORWARD POSITION



THRUST EFFECTS ON FIN NO. 4 NORMAL FORCE CHARACTERISTICS-FIN IN FORWARD POSITION



THRUST EFFECTS ON FIN NO. 2 NORMAL FORCE CHARACTERISTICS-FIN IN FORWARD POSITION



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